IMSA

PRESENTATION DAY

April 28, 2004

A Pioneering
Educational Community

Stephanie Pace Marshall, Ph.D.
President

Dear IMSA Friends:

Students who attend the Illinois Mathematics and Science Academy do not have to wait until they graduate from college to begin to make significant contributions to science, mathematics, the humanities and the world around them.

Through the IMSA Student Inquiry and Research (SIR) Program, IMSA's young apprentice investigators open our eyes to what is possible in fields such as cell biology, genetics, computer science, biomedical engineering, science education, economics, bacteriology, archeology, biotechnology and immunology.

And the world is paying attention to what our students are saying.

Professional associations such as the American Association for the Advancement of Science (AAAS), the National Association of Biology Teachers, the American Society of Microbiology, and professional research journals such as Nature, Biology of Reproduction, Neuroscience Research Communications and Ceramic Engineering and Science Proceedings have all featured the research work of IMSA students through presentations and publications.

The Student Inquiry and Research Program fosters the development of students as highly skilled and integrative problem finders, problem solvers, and apprentice investigators, all skills required to succeed in the global workplace of the 21st Century. IMSA's SIR Program serves as a model learning environment for the future and provides a variety of research learning experiences (both in and out of class) for students to pursue compelling questions of interest, conduct original research in science, French-American history, and creative and performing arts, create and invent products and services, share their work through presentation and publication, and collaborate with other students, mentors, scholars, researchers and inventors throughout the world.

As you begin to turn the pages and learn about the extraordinary research work of IMSA's young investigators, I hope you will begin to see what is possible. We believe that our goal of creating "decidedly-different learners" is already being met and will make a profound impact on the future of humanity.

For additional information about Student Inquiry and Research Program contact IMSA Director for Curriculum and Assessment Dr. David Abler (630) 907-5886.

Sincerely,

Stephanie Marshall

Stephanie Pace Marshall, Ph.D.
President

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ILLINOIS MATHEMATICS AND SCIENCE ACADEMY
"A Pioneering Educational Community"

SIXTEENTH ANNUAL IMSA PRESENTATION DAY
April 28, 2004

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Kasia Szremski (IMSA '01) and Lyra Haas (IMSA '05) at archaeological site in Caral, Peru. Caral, the oldest known urban center in the Americas, was discovered by IMSA mentors Dr. Winifred Creamer and Dr. Jonathan Haas.

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April 28, 2004

SCHEDULE OF ACTIVITIES

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Emily I. Coleman, Dr. Dana Goodman, Ms. Desiree Tolbert

A-149 **CHARACTERIZATION OF THE EXPRESSION PATTERN OF THE FIBRILLIN3 GENE IN HUMANS**
Eugenia Kim, Dr. Margrit Urbanek

A-151 **THE INFLUENCE OF A NEUROPEPTIDE Y Y5 RECEPTOR ANTAGONIST ON PHOTIC AND NON-PHOTIC INPUT TO THE MAMMALIAN CIRCADIAN PACEMAKER**
Sanaa Qamar, Dr. Teresa H. Horton

A-155 **THE BIODEGRADIBILITY OF A CORN PROTEIN POLYMER**
Heidi Kim, Dr. Donald Dosch

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A-113	**THE CHICAGO MERCANTILE LIGHT ARTILLERY BATTERY: UNKNOWN HEROES OF THE CIVIL WAR** Ajay Reddy, Dr. Claiborne Skinner
A-115	**EFFECTS OF E50K MUTATION IN THE OPTINEURIN GENE ON TRABECULAR MESHWORK CELLS** Eric Chang, Dr. Beatrice Yue
A-117	**SUPPRESSION OF METASTASIS BY MITOGEN-ACTIVATED PROTEIN KINASE KINASE 4** Bhavi D. Mehta, Dr. Carrie Rinker-Schaeffer
A-119	**A CHANGING WORLD AROUND US** Jasmine A. Henry, Ms. Joy Meek
A-121	**THE EFFECTS ON THE LEVELS OF ANTICOAGULATION IN PATIENTS UNDERGOING INTRINSIC AND EXTRINSIC TREATMENTS** Karen Chien, Dr. Joseph Cuhanan, Dr. Jawed Fareed, Dr. Debra Hoppensteadt
A-131	**AMERICA'S ANTI-COMMUNIST AGENDA AND KOREA, 1945-1950** Jenny D. Kim, Dr. Lee Eysturlid,
A-147	**CORRUPTION IN THE CITY THAT WORKED: CHICAGO AND THE RICHARD J. DALEY ADMINISTRATION** Christine Foster, Dr. Christian Nokkentved
A-149	**RE-EXPRESSION AND DECREASED PHOSPHORYLATION OF THE MYOSIN LIGHT CHAIN ISOFORMS OCCURS WITH AGE AND HEART FAILURE** Megan Narula, Dr. Paul H. Goldspink
A-151	**INVESTIGATION INTO THE METHYLATION STATUS OF RASSF1A PROMOTER IN TWO IMMORTAL SV40-INFECTED CELL LINES** Manisha Chandar, Dr. Kathleen Rundell
A-155	**CELLS THAT ARE ABLE TO SUPPRESS APOPTOSIS HAVE THE POTENTIAL TO BECOME LEUKEMOGENIC** Sarah Jeong, Dr. Andrew Vaughan
Lecture Hall	**MAKING THE VIDEO** Uchenna U. Egwu, Fred N. Ricks, Dr. John Eggebrecht

TWO AND THREE DIMENSIONAL LEFT VENTRICULAR REMODELING FOLLOWING MITRAL VALVE REPLACEMENT AND REPAIR

Presenter
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Mentors
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Several complications on the left side of the heart such as mitral regurgitation (MR), either from mitral valve prolapse or ischemia induce morphologic changes in left ventricular morphology. Remodeling of the left ventricle can be detected in two and three dimensions. We have previously studied the 2D changes up to 2 years following surgical correction. We have determined that there is improvement in the volumes, mass and ejection fraction early on. However, dynamic shape changes are detected up to 2 years. The 3D evaluation is a better determinant of volumes.

Patients studied underwent mitral valve repair (MVr,) and mitral valve replacement (MVR) for chronic mitral regurgitiaton. Two and three dimensional remodeling in pre surgery, six months post surgery, one year post surgery and two years post surgery was examined. Remodeling from both hemodynamic and morphologic standpoint is rarely looked at. This study aimed to define the morphologic changes in patients that underwent MVr, MVR during two years and to realize a difference in the rates of remodeling between MVr and MVR.

PROJECT ICARUS: DESIGNING A PLANE THAT CAN FLY ON MARS

Presenters
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Through Project Icarus, we sought to design an aircraft that was capable of flying on Mars. During our inquiry, our team designed a fuselage, wings, engines, and control surfaces – all necessary to test our aircraft's capability of simulated Martian flight. For the fuselage, we chose a very cylindrical design with the front-end coming to a smooth tip. Compared to the fuselage, our wings are much longer than they would be on an Earth plane. Their main purpose is to garner a large amount of lift without as much drag. Finally, we decided on dual engines in the back of the fuselage. Our plane doesn't rely on large quantities of fuel like many Earth planes do; instead, a thrust-and-glide procedure is optimal. By using a computer flight simulation program, we extensively tested our designs and determined that it would indeed be successful if it actually did fly on Mars. We did have several problems during the design phase, including how to turn properly and safely land. During Presentation Day, we will display clips of our plane in action and provide a basic overview of the challenges that presented themselves.

ONE, TWO, THREE, FORESTRY!

Presenter
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Mentor
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Forestry plays a significant role in the ecosystem and it is the next generation's responsibility to document and nurture it while Iowa's forests are still intact. The Gossman farm is located in the eastern part of Iowa where there is a rich array of specimens to study. The goals of the Gossman forestry mentorship include improving the timber stand, identifying and possibly eliminating invasive species, and updating the current forestry management plan. In our survey process, we record tree measurements and collect samples from various species on the farm. A complete sample from a tree includes a bark sample, a leaf sample, a terminal bud sample, and a picture. In the wintertime, when tree growth is minimal, diameter and circumference measurements are taken along with GPS coordinates.

This year our group collected leaf and bark samples with the help of Dr. Neese, a PhD botanist. We identified the samples in the field, pressed our samples in plant presses, and mounted them on herbarium quality paper . As part of timber stand improvement, we girdled hackberry trees and used pesticide to kill box elder trees and grapevines, which can take over a forested area. We have planted over 1500 black walnut, oak, and butternut seeds and seedlings in order to reforest old farmland. In March, we attended the Tri-State Forest Stewardship Conference, where we learned about invasive species, woodland management, and creating digital forestry images.

THE DESIGN AND REALIZATION OF FLASH ANIMATION

Presenters
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The goal of our senior research was to design an original Flash animation movie with more challenging societal commentary and animation techniques than the spoof of Hulk Hogan produced last year. After brainstorming topics, we decided to satire the life of Arnold Schwarzenegger. Our first challenge was tailoring our script for a general audience by avoiding complicated subject matter and including enough detail to understand his life. To convey our ideas more vividly, we made storyboards and animation notes to go along with our script. We explored the advantages of frame-by-frame animation and shape tweens to develop smoother animation than last year's film. We wrote and recorded original music for the soundtrack of our Flash animation. The Adventures of Coinbird and Murderous Deception, two other Flash-animated films, are the inspiration for our project because they illustrated the cartoon-like quality we wanted to replicate. Our finished seven minute video will be presented for viewing.

INTRODUCTION OF GREEN FLUORESCENT PROTEIN INTO LYCOPERSICON ESCULENTUM BY MEANS OF AGROBACTERIUM TUMEFACIENS

Presenter
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Advisor
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Agrobacterium tumefaciens has the ability to transfer DNA to plants and has thus revolutionized plant biotechnology. The purpose of this inquiry is to introduce green fluorescent protein (GFP) into *Lycopersicon esculentum* (tomato) by Agrobacterium-mediated gene transfer. Upon plant contact, the T-DNA portion of the Ti plasmid of the bacteria is integrated into the nucleus of plant cells. Using polymerase chain reaction (PCR), the T-DNA was isolated from A. tumefaciens and ligated into pGEM-T Easy. The ligation was transformed into *Escherichia coli* JM109 for isolation and amplification. The next step is to construct pTA1 , which will combine the T-DNA with the GFP gene. This plasmid will then be introduced into A. tumefaciens, with help from the mobilizer plasmid pRK2013.

LEADERSHIP FOR THE FUTURE

Presenters
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Mentor
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The Community Youth Learning Experience mentorship is an after school program that offers educational and personal opportunities for the children of Cabrini Green. As part of our mentorship, we conducted a lab centered on leadership, healthy decision-making, goal setting, and goal realization. With our group we worked on developing public speaking skills, expressing opinions, building self-confidence, and motivation to achieve. Our time with the kids has included impromptu speeches, a debate on legalizing marijuana, and various discussions. We have also challenged the students to address a problem that they observed in their community and to plan and carry out a solution. This project will be something that they are genuinely concerned about and hopefully will carry over to later years. Within our labs, we aim to foster an open and intimate environment. We encourage our students to speak openly on issues pertaining to their community and personal life. Our goal throughout has been to provide the students with the means and tools to grow and succeed in the world. We aspire to act as positive role models for these children and to open up the possibilities for their futures.

DEEP BRAIN STIMULATION FOR PARKINSON'S DISEASE

Presenter
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Mentor
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Various medications including L-dopa and dopamine agonists are frequently used as treatments for Parkinson's disease (PD). However, these treatments are associated with long-term motor complications that do not respond to medical therapy. Surgical therapy is helpful for patients with advanced PD. Electrical stimulation through electrodes implanted into the brain, has received a fair amount of acceptance. The proposed effect of deep brain stimulation (DBS) is to inhibit activity in the targeted region. As DBS is a recent innovation, the overall effectiveness of the procedure is still unclear. The stimulation parameters used in the DBS techniques are measured by amplitude, pulse width, rate, and electrode settings. This study evaluates the effect of DBS surgery on quality of life in 16 patients with PD. The average age of these patients is 67 years (44-78). None of the patients were diagnosed with young onset disease; the average age at surgery was 66 years (43-77). The average duration of the disease was 11 years (6-27). The male to female ratio was 10:6. Quality of life was measured through the Unified Parkinson's Disease Rating Scale (UPDRS). On this scale, the Activities of Daily Living average score improved from 14 to 10.5 in the "on" stage, and from 24.9 to 16.3 in the "off" stage. This was a significant improvement from the statistical and clinical points of view.

SUPERCOOLING AND OVERCLOCKING THE AMD ATHLON XP™

Presenter
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Munan Xue, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL, 60506; rmuxue@imsa.edu

Advisor
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One internal aspect of a computer that few people consider is the cooling system. Most people use the CPU heatsink included with the retail box of the processor. This heatsink keeps the processor under the maximum safe operational temperature. Our inquiry evaluated computer performance with different cooling methods. We used the AMD Athlon XP™ 2000+ CPU and the Athlon XP™ 2400+ and changed the clock speed of the processor by varying the bus speed until the clock speed matched that of faster processors. Our maximum operational temperature was set to 75oC. We overclocked the Athlon 2000+ to 2600+ Thoroughbred™ speeds, and the Athlon 2400+ was overclocked to an 2800+ Thoroughbred™ equivalent. A water-cooling system from Ahanix was used in lieu of a retail 2500+ heatsink. When we overclocked the processor with our AMD retail heatsinks, notable cooling problems occurred. Our 2000+, overclocked to 2400+, performed worse in benchmarks than the retail 2400+. Similar results were obtained when the 2000+ and the 2400+ were both overclocked to 2500+ and 2600+ speeds. At 2600+ speeds, the overclocked 2000+ encoded a 100 minute song from ".wav" format to ".mp3" format a full minute slower than the overclocked 2400+. The performance gap between the overclocked processors decreased when we switched to our water-cooling system.

DIP-PEN NANOLITHOGRAPHY OF REACTIVE ALKOXYSILANES ON GLASS FOR USE IN PROTEIN-BASED CIRCUITRY

Presenter
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This work involves developing the means for controlling the spatial positioning and chemical coupling between fully functioning proteins. We are approaching this goal through the use of Dip Pen Nanolithography (DPN) with an Atomic Force Microscope (AFM) in an attempt to pattern fully functional proteins like a circuit on a silicon chip. The proteins can be thought of as "switches" in analogy to an electrical circuit, and the "wires" will be formed from microfluidic channels through which molecules can flow. The activity of this circuit will be observed through the use of fluorescence imaging, down to single molecule sensitivity.

On the short term, we worked specifically on perfecting the DPN process, and confirming the viability of "drawing" biological circuits on a transparent silicon-based substrate (glass). A great deal of the research focused on accurately controlling the AFM and, using the "Nanolithography" software package, programming the microscope to draw specific patterns in the substrate. In addition, specific cleaning and drawing methods and procedures were defined and improved upon. While we have not yet produced a functional circuit, as is the final goal, success rates of "writing" on the glass are much improved, and the method and procedures for doing so successfully are being finalized.

EFFECT OF IMPLANTATION OF THE KANTROWITZ CARDIOVAD ON THE PROGRESSION OF LEFT VENTRICULAR GROWTH DURING CONGESTIVE HEART FAILURE

Presenter
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Mentor
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Congestive heart failure (CHF) is the leading cause of death in the United States contributing to approximately 50,000 deaths each year. Approximately 400,000 new cases are diagnosed each year and nearly 5 million people currently live with the disease in the United States alone . Heart failure is characterized by the inefficiency of the pumping heart . The heart is no longer able to handle the large volume of blood it needs to send to the rest of the body. Therefore, the heart grows abnormally large. There are many effective treatment therapies for CHF. The most effective thus far is mechanical auxiliary support in the form of a ventricular assist device (VAD). This research focuses on the Kantrowitz CardioVAD and its effect on native heart function. Results will be obtained using 2-dimensional echocardiography and other medical records. Essentially, this research will focus on the effect of the implantation of the CardioVAD on the progression of CHF. If the CardioVAD is effective in slowing or stunting growth of the heart during CHF, it will provide an effective treatment therapy for a universal problem.

3D RECONSTRUCTION OF TISSUE STRUCTURE FROM 2D IMAGES OF TISSUE SLICES

Presenter
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Mentor
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Recent developments in medical imaging technologies have allowed scientists to obtain 2D images of tissues in the human body in order to help in diagnosing cancer during its early formation. However, current technology only allows for images of very thin 2D slices of tissue to be taken. This results in the loss of much necessary data of the 3D tissue structure including the distribution of cells, frontier structure, and the progression of cancer cells. The purpose of this project is to create a 3D reconstruction of tissues given many 2D slices in order to retain this information. There are a variety of methods that can be used to assemble the 3D structure, but the most effective are clustering and convoluting. The process of clustering uses matrices in order to build the framework of the image in order for the computer to recognize where the data and main part of the image lies. Next, convolution, also called edge detection, is used to find the optimal place to merge the images in order to create a 3D structure. After this process is complete, pattern matching is used in order to help find similarities and differences in the framework of the images between healthy and unhealthy patients over time. Therefore, the more information that this program is provided, the more effective this program becomes in recognizing cancer during its early formations. The overall goal of this project is to create a means for which the 3D structure of tissue can be obtained from a given set of 2D images in order to be manipulated to help in the diagnosing of cancer.

QUID PRO QUO- REWRITING THE RULES FOR CAMPAIGN CASH

Presenter
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Mentor
Ms. Jennifer Hensley, Illinois Chapter of the Sierra Club, 200 N. Michigan Avenue Suite 505, Chicago, IL, 60601-5908

When dealing with environmental policy, it becomes easy to lose sight of the fact that the lives of real people are at stake. Nowhere is this more evident than in our nation's capital, where teams of corporate executives are hard at work obliterating environmental and public health safeguards.

Environmental protections have taken over thirty years to formulate, but in just over three years in office, the current administration has dismantled hundreds of tools used to defend the planet. Where executive fiat is impossible, congressional approval has been sought on plans to expedite the liquidation of our natural environment for a few years of pollution-based prosperity.

Regardless of how appalling the actions may seem, the questions still begs to be asked, "Why should one care?" Does it matter to you that nuclear waste from around the country is being shipped to Nevada when you live in Illinois? If St. Louis and Chicago's Union Station are being used as transport hubs, and every carton of nuclear waste from every commercial reactor east of the Mississippi will pass over the Land of Lincoln, would you be more likely to care then?

To be effective, environmental advocacy must be localized to people's backyards. This investigation developed a dossier of the administration's environmental policy and the effects that it has had on Illinois in particular.

THE EFFECTS OF ACETYL-SALICYLIC ACID ON PACLITAXEL INDUCED APOPTOSIS ON ARTERIAL SMOOTH MUSCLE CELLS

Presenters
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Intimal hyperplasia occurs when the intima, the extremely sensitive innermost layer of an artery, is irritated and tissue scars unnecessarily in an attempt to heal itself. It causes serious complications in the world of vascular surgery, as restenosis occurs in nearly 40% of patients having balloon catheter procedures to remove arterial blockages.

Paclitaxel is a new drug whose applications have been widely tested. It hyper aligns microtubules during mitosis, preventing cells from proliferating. This characteristic has proven the drug efficacious in some forms of cancer treatment, especially breast cancer, yet it tends to be extremely harsh on cells, often inducing a high rate of apoptosis ("cell suicide"). Aspirin is a COX-2 inhibitor, and has been proven effective in suppressing the apoptosis induced by paclitaxel on ovarian cancer cells.

We have tested the effects of aspirin in conjunction with paclitaxel on arterial smooth muscle cells, the cells found beneath the intima of arteries, and observed the cells' apoptosis rate. Our pilot experiment results showed us a dose dependent decrease in cell number when paclitaxel was administered first with constant aspirin concentrations second. Yet, when aspirin was administered first with varying paclitaxel concentrations afterwards, the cell counts remained relatively constant.

ELECTROCHEMICAL FABRICATION OF COBALT NANOROD ARRAYS IN POROUS ALUMINUM OXIDE TEMPLATES

Presenter
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Mentor
Dr. Vinayak Dravid, Northwestern University, 2220 Campus Drive 1133 Cook Hall, Evanston, IL, 60208-3108; 847-467-1363; v-dravid@northwestern.edu

Synthesis and fabrication of nanostructure "building blocks" constitute the primary challenge (or an opportunity) to harness the promise of emerging nanoscience/nanotechnology. Linear, one-dimensional forms of nanostructures (e.g., wires, whiskers, rods, tubes etc.) are one class of nanostructure "building blocks," which exhibit unique physical, chemical and electromagnetic properties which provide considerable scientific excitement, with great technological implications. We have made considerable progress in synthesis of one-dimensional magnetic nanostructures using a "template"-based approach. We have developed and implemented a procedure for fabricating cobalt nanorods within the pores of an anodic aluminum oxide template by DC electrodeposition. The aluminum oxide membrane is removed from the aluminum substrate upon which it is grown and sputter-coated with a thin layer of silver to increase conductivity. By altering experimental variables (e.g. deposition voltage, deposition solution, etc.), a range of different nanorods can be prepared. This approach allows for easier production of cobalt nanorods for applications such as ultra high-density data storage, magneto-diagnostics, therapeutics, sensing etc. —

LIGHT-INDUCED PHASE SHIFTS OF CIRCADIAN RHYTHMS

Presenter
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Mentor
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Daily rhythms of core body temperature and the hormone melatonin are the major outputs of the circadian pacemaker and thus can be used to estimate its timing. We study these rhythms to better understand and map these rhythms to come up with better treatments for circadian disorders like sleep apnea and insomnia. This project analyzes different mathematical methods of capturing these rhythms. Midpoint of melatonin (an average of two points on the melatonin rhythm) was found to be most representative of circadian phase shifts.

WE <3 BIRDS: AN ORNITHOLOGICAL SURVEY OF THE GOSSMAN FARM IN ZWINGLE, IOWA

Presenters
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Mentor
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The Gossman Farm is located in Jackson County, Iowa. There are 403 species of birds known to reside in Iowa, 138 specific to Jackson County. The 670-acre farm was surveyed and twelve spots were pinpointed for observation. Thus far 35 species have been identified. Population surveys take many years to produce substantial data; it was our main goal this year to establish a base line to work with on a long-term basis so that data from year to year are similar. Structures to aid the project have been researched, including nest boxes, hack towers, and blinds, with the construction of nest boxes for Barn Owls being the first project completed. Each team member has focused on a specific topic of ornithology, including migration, birdsongs, nocturnal birds, and much more. The team wishes to thank Bruce and Marlene Ehresman and Dr. Christian Nokkentved for their help this year and to come.

IMSA ON WHEELS: THE VIDEO

Presenter
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Ms. Britta McKenna, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Kids Institute, Aurora, IL, 60506; 630-907-5987; britta@imsa.edu

IMSA on Wheels has successfully presented science assemblies to approximately six thousand elementary students in forty-two schools across northern Illinois since January 2003. Considering IMSA on Wheels' dramatic success, this inquiry focused on sustaining the program and expanding its reach through the use of technology by piloting the program on video. The assembly program was rewritten and expanded into a 50-page script that included careful description of sets, blocking, and camera shots. The project was then filmed with the assistance of IMSA's Toyota Video Production Laboratory. The footage was digitally edited using Final Cut Pro, a professional nonlinear editing software program. The video features science principles geared toward an elementary school audience, such as physical state changes and indicators of chemical reactions. Animation was used to illustrate molecular phenomenon. This fast-paced video was designed to spark student interest in science, to introduce IMSA to other communities, and to involve IMSA students as teachers and role models for younger children. It will be produced on DVD, and 1,500 copies will be distributed to schools and public libraries statewide.

CREATING A MEANS OF COMMUNICATION: THE CONSTRUCTION OF LANGUAGE

Presenter
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Advisor
Dr. Dennis Czerny, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, English, Aurora, IL, 60506; 630-907-5974; dczerny@imsa.edu

Communication is the key to society and the key to thought. I have worked to understand the basics of languages, and to know the unifying characteristics between all natural languages in order to create a language, following Tolkien's passion. Studying the origins of natural languages indicated that perhaps all languages sprung from one source and that, with time and distance, dialects varied greatly and became new languages, breaking old lines of communication. Language is bounded by the culture of the society speaking it, and language in turn can bind the mind in what it thinks or how it reacts. However, neither culture nor language is dependent on the other. The culture I am creating is based on natural languages and cultures, and is not designed to be alien. I have decided on a phonetic system and have also chosen to include vowel harmony and head markers which are used in some African languages. I have looked into idioms, which show the creativity and values of a culture, but I am focusing most on the lexicon and grammar structure. The final part of my project includes creating a writing system and compiling a dictionary.

THE PHILOSOPHICAL IMPLICATIONS OF THE EVOLUTION OF ARTIFICIAL INTELLIGENCE

Presenters
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Mentor
Mr. Michael Ososky, Applied Computer Technology, 69 South LaSalle St., Aurora, IL, 60505; 630-896-2281 x24; 630-859-7576; mike@expocad.com

For the first time in the 4.7 billion year history of the Earth, an organism has evolved that has the capacity to create an intelligence equal to or even superior to its own. That organism is *Homo sapiens* and the emerging creation is AI. AI or Artificial Intelligence is one of the most rapidly developing fields of research. The goal of our mentorship is to explore the past, present, and future implications of the advent of AI. The process of biological evolution has led to the development of memetic evolution, the cultural evolution of ideas. This memetic evolution has allowed for the creation and development of AI based on the evolution of human intelligence. Through the analysis of literature from the greatest minds in Artificial Intelligence and related fields and through in-depth and insightful group discussions, we feel we have a deeper understanding of the ethics and philosophy of AI and we are well prepared to become stewards of a new era of technology and intelligence.

DEVELOPMENT OF SOCIAL BEHAVIOR IN AN INFANT GORILLA

Presenter
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Mentor
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Nadaya, a three year-old Western Lowland Gorilla (*Gorilla gorilla gorilla*), resides with his father, mother, three other related adult females, and two non-related adult females at Brookfield Zoo. As gorillas typically wean and in the wild begin nesting separately from their mothers around the age of three, this time period normally covers significant developments in a gorilla's social behavior pattern. A comparison of 45-50 hours of first and third year all-occurrence and scan behavioral data for Nadaya and his mother shows Nadaya interacting increasingly differentially with individuals other than his mother over the period of three years. This appears to be related more to age than relatedness of animals. However, with an absence of true age-mates (the youngest playmates in the group are 9 years old), he divides his time spent in play more equally among the other individuals in the group than normally would be the case for an immature gorilla. During Nadaya's third year, his mother spends significantly more time alone than she did when Nadaya was regularly in close proximity. The presence of normal social opportunities such as a presence of age mates is known to be important for the development of healthy social behavior in humans, and is likely to be just as critical for the development of normal social behavior in gorillas. Further investigations on gorilla infants in a range of social settings may provide valuable insights.

DIFFERENTIATION OF BERGMANN GLIA USING DUAL-LABELING ZENON TECHNOLOGY™

Presenter
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Mentor
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Bergmann glia are found within the Purkinje cell layer of the cerebellum. Also found in the cerebellum is glutamate, a neurotransmitter transported via glia. Excess glutamate often leads to excitotoxicity. GLAST is a glutamate regulator found in Bergmann glia. Caspase-3 is found in all neural cells, including all glia, and it is a marker for cellular apoptosis. This project adapts the recently developed Zenon Technology™ (ZT) to dual-label for GLAST and caspase-3 for the differentiation of Bergmann glia from other Purkinje cells. The successful utilization of ZT in this scenario means faster detection of Bergmann glia, which can accelerate studies of glutamate excitotoxicity in the cerebellum.

Observed from the single-labeling calbindin assays was the need for balance between working concentration and complex-formation time. Also noted was that at a 1:1000 working concentration, the complex became less effective regardless of time given for complex formation. Results from multiple single-label experiments showed that a 3:1 molar concentration was necessary for proper labeling. In the ZT trial for labeling caspase-3, no Bergmann glia labeled. Time constraints prevented proper experimentation with GLAST. Current data shows that ZT is not well-suited for labeling caspase-3 in vitro, but further testing is necessary for final conclusions.

INVESTIGATION INTO THE METHYLATION STATUS OF RASSF1A PROMOTER IN TWO IMMORTAL SV40-INFECTED CELL LINES

Presenter
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Mentor
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RASSF1A is a tumor suppressor gene that may play an important role in inhibiting tumor growth in mesothelioma. It has been shown previously that the regulation of this gene can be controlled by methylation of the promoter sequence, and this has been linked to the presence of the virus SV40. We are studying two cell lines, one expresses both the Large-T and small-t viral antigens, while the other expresses only Large-T. We are asking whether the RASSF1A gene will be methylated, and how the small-t viral antigen affects the methylation of the gene. In the early passages of these two cell types, no methylation has been observed, using methylation-specific PCR. These results were supported by the failure to detect any decrease in expression using reverse-transcript PCR. This may be because the latest passage of our cells was only at passage 38, and cells studied by others showed methylation only after 50-80 passages. Additional passages of our cell lines will be needed to determine whether small-t affects RASSF1A promoter methylation.

EFFECTS OF E50K MUTATION IN THE OPTINEURIN GENE ON TRABECULAR MESHWORK CELLS

Presenter
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Mentor
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One major problem in the United States is glaucoma, a blinding condition that more than three million people have. Glaucoma is usually related to high intraocular pressure, or high eye pressure. Specialized cells, trabecular meshwork cells, control the flow of aqueous fluid in the eye. When these cells malfunction, the fluid will build up and elevation of intraocular pressure can occur. Genetics plays a role in glaucoma. Two genes have been identified as possible candidates for causing glaucoma, myocilin and optineurin. We have hypothesized based on genetic studies that a mutation of the optineurin protein, E50K, may be a causative factor of glaucoma. E50K signifies the change of the 50th amino acid from glutamate to lysine. The mutation could cause a change of trabecular meshwork cell properties and how they control the flow of eye fluid. As of now, we have made the mutation and transfected the E50K construct into human trabecular meshwork cells in culture. No significant morphological differences between the transfected and normal cells have been found so far. Molecular studies, such as protein and transcript analyses, will be needed to further explore the effects of the mutation on trabecular meshwork cells.

INVESTIGATION OF REINFORCED CARBON-CARBON MATERIAL USING ULTRASONIC WAVE PROPAGATION

Presenter
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Mentor
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In the wake of the loss of space shuttle Columbia more than one year ago, effective and practical nondestructive evaluation (NDE) methods for the orbiter that can assess damage levels are crucial for safe flight. The wing leading edges and nose cap of the shuttle are composed of a material known as reinforced carbon-carbon (RCC), which protects the spacecraft's aluminum primary structure from the intense heat of atmospheric reentry. Obviously, any damage or deterioration of the RCC that compromises the integrity of this thermal protection system would threaten the safety of the entire shuttle and its crew. One-sided air-coupled ultrasound has already been demonstrated to be a useful NDE method for detecting visible physical anomalies on the surface of various materials, including RCC. Hopefully, with further development, it can also be used as an efficient tool for determining amounts of mass loss – internal RCC damage that can occur as the material endures high temperatures for extended periods of time. Air-coupled ultrasound was used to investigate a series of RCC samples with simulated impact damage, which were placed in a controlled high-temperature furnace for varying durations. The pre- and post-furnace samples were inspected, as well as RCC material previously exposed to flight conditions.

THE PARTICULATE WORLD OF INTERMEDIATE FILAMENTS: A STUDY OF IF PARTICLES

Presenters
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Mentors
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Dr. Robert David Goldman, Northwestern Medical School, Department of MED-Cell & Molecular Biology, 303 E Chicago Avenue #W11145, Chicago, IL, 60611; 312-503-4215; r-goldman@northwestern.edu

Intermediate filaments (IF), along with microtubules (MT) and microfilaments (actin), are an essential part of the cytoskeleton; they help maintain the structural integrity of the cell. Traditionally, IF have been thought to be a relatively stable network of proteins, however it is now known that when cells move, this network must be quickly reorganized. The network breaks down and highly motile aggregates of IF called "particles" are found throughout the cytoplasm. Last year, we found evidence of protein synthesis next to many of these particles. Since mRNA is one of the major players in making protein, we looked for the presence of IF mRNA near particles and attempted to determine whether a relationship between particle motility and protein synthesis existed. Our project is an extension of last year's research. We have been attempting to determine molecular motor associations with both the protein synthesis machinery as well as with the protein product, i.e. the IF particle.

IDENTIFICATION OF PIST PDZ DOMAIN INTERACTORS

Presenter
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Mentor
Dr. Dane Chetkovich, Northwestern University Medical Center, 303 East Chicago Avenue Ward 10-210, Chicago, IL, 60611-3008; 312-503-4362; d-chetkovich@northwestern.edu

Glutamate receptors are proteins that mediate most excitatory communication between neurons in the brain. One type of glutamate receptor, α-amino-3-hydroxy-5-methylisoxazolepropionate receptor (AMPAR), is moved to and from the synapse to control the strength of synaptic transmission, and this movement is critical for the synaptic changes that underlie some forms of learning and memory. Abnormal targeting of AMPARs can cause epilepsy and learning disorders. PIST (Protein Interacting Specifically with TC10) is a protein important for AMPAR targeting to synapses, in that it acts as a chaperone for the AMPAR and an AMPAR binding protein, stargazin. PIST contains several important domains, regions that are conserved between many proteins, and are known to have specific functions. For PIST, these include two coiled-coil domains, a leucine zipper, a PDZ domain (named after several proteins that contain this domain, PSD-95, Discs Large, and Zona Occludens), and an acid cluster. PIST interacts with several proteins through its coiled-coil region, and its PDZ domain is known to bind to and traffic many transmembrane proteins outside the brain. PIST binds to stargazin/AMPAR at amino acid residues separate from its named domains. However, experiments in our lab suggest that although the PIST PDZ domain does not bind stargazin/AMPA receptors, it is also critical for the synaptic targeting of these proteins. Because the PIST PDZ domain is important for AMPAR synaptic targeting, we sought to identify novel proteins that interact with the PIST PDZ domain. Using an assay of protein-protein interaction, the yeast two-hybrid system, we screened a cDNA library of brain proteins using the PIST PDZ domain and obtained 100 possibly interacting clones. By reintroducing these clones into yeast containing the PIST PDZ domain, we will confirm specific interaction with PIST. We will perform restriction digest and DNA sequencing of interacting clones to identify the interacting proteins. By identifying PIST-interacting proteins, we will shed light on the mechanism by which PIST serves as a chaperone for stargazin/AMPAR in their delivery to the synapse.

THE EFFECTS ON THE LEVELS OF ANTICOAGULATION IN PATIENTS UNDERGOING INTRINSIC AND EXTRINSIC TREATMENTS

Presenter
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Mentors
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Dr. Debra Hoppensteadt, Department of Pathology Loyola University Medical Center 2160 S. 1st Avenue Maywood, IL 60153 708-216-4625; dhoppen@luc.edu

Atrial fibrillation, a cardiac disorder, is found in about two million Americans resulting in approximately 8,000 deaths annually. In this disorder, the upper two chambers of the heart (the atria) quiver instead of beating regularly and effectively. This leads to stasis of blood in the atria and causes the development of clots. Plasma samples from two groups of patients were analyzed to determine the effects of two different types of treatments on the coagulation system. One group was given the oral anticoagulant Coumadin, and the group undergoing cardioversion through transesophageal echocardiography (ACUTE II) was given low molecular weight heparin intravenously. The tests preformed included prothrombin time (INR) for the oral anticoagulant treated group and HepTest and anti-Xa/anti-IIa assays for the low molecular weight heparin treated group. Thrombin generation tests were performed in both groups. This presentation will provide an update on the pathogenesis of atrial fibrillation and the degree of anticoagulation observed in various treatment groups.

A STUDY OF THE CORRELATION BETWEEN THE TYPE OF GALAXY AND ITS LUMINOSITY

Presenter
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Mentor
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The purpose of this research is to determine whether or not a relationship between the type of galaxy and its luminosity. Data such as redshift, position, and apparent magnitudes were taken from the Sloan Digital Sky Survey. By deriving an equation and applying it the given data, it was possible to find the absolute magnitudes of each galaxy. Thus, the absolute magnitudes, which are directly related to the luminosities, of a set of approximately ten-thousand values were found. The absolute magnitudes ranged from -25.8 to -18.1 with a few outliers. The data was then plotted on a histogram and by dividing the histogram into regions; it was determined whether the galaxies in each region section have similar characteristics or are the same type.

THE SEARCH FOR A HUMAN SUPPRESSOR FOR THE HIV PROTEIN VPR.

Presenters
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Mentor
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Infection by human immunodeficiency virus (HIV) is a precursor to the acquired immune deficiency syndrome (AIDS). Vpr, a non-structural accessory protein of HIV, plays a significant role in the entry of HIV-1 into the human body's CD4-T cells as well as subsequent HIV replication. In addition, effects such as cell cycle arrest and white blood cell depletion make Vpr a key player in HIV viral activation. It is believed that if Vpr can be successfully suppressed, symptoms of HIV infection will be attenuated. The purpose of our experiment is to find a human protein that can effectively suppress Vpr. We accomplish this task by transforming a human cDNA library into fission yeast cells containing Vpr and screening for surviving candidates as well as other markers such as green fluorescent protein (GFP), which eliminates background due to the loss of Vpr. From screening about 20,000 human cDNA transformants, we have found a few suppressor candidates and are working on determining whether these candidates are actual suppressors.

THE ANALYSIS AND CRAFTING OF YOUNG ADULT FICTION

Presenter
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Young adult fiction was read and researched to determine its defining characteristics. Research was aimed to discover common trends. Tense, character, point of view, voice, and overall style were all observed. Young adult novels of various genres and intended age groups were considered, including fantasy, adventure, realistic fiction and also novels of unorthodox form. Some of the common trends found in the fiction researched were a freedom of form and a propensity for adult figures to be minor players in the story. It is then imperative to young adult fiction that the main characters are of adolescent age. Another major finding was that there is often an underlying theme that pushes the reader to gain knowledge from the book or to somehow be changed by it. Another aspect of the project was the composition of young adult fiction. The composition included some writing exercises, short stories, and some sections of a longer piece. These pieces were revised and rewritten after discussion. The trends of the young adult fiction researched were implemented during composition to better the work.

DEVELOPMENTAL STRATEGIES IN COMMODITY OPTIONS A.K.A. HOW TO GET RICH!

Presenters
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A wise man once said, "You will never get rich working for your money; the only way to get rich is making your money work for you." Therefore, we asked ourselves: Is it possible to develop an investing strategy that outperforms all traditional investing methods? After looking at the stock market, mutual funds, and commodities, we decided it would be wisest to invest in the futures sector of the commodities market. We decided that options, a derivative of the commodity futures market, was the best way to invest our money because the market is flexible enough to give us the freedom of being creative in evolving our strategy. We set out to create a strategy that yields an exceptional return no matter where the market goes. Our strategy has evolved into us being the insurance agents for the rest of the investors in the market. Since then , we have written specific rules based on our commodity market exchanges. To date, we have yielded an annual return of 82%. This is 50% better than the best investors in the world, namely Warren Buffet or George Soros.

ERGODIC PROPERTIES OF NONLINEAR BILLIARDS

Presenters
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Mentor
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The effects of nonlinear behavior reach across science, from astronomy to economics, cardiology to quantum dynamics. Yet despite the tremendous variety of nonlinear or chaotic systems, some properties of their behavior appear to be universal. Our research investigates these properties in a two-dimensional billiard system, a closed planar region in which a particle propagates according to Newtonian laws. While ergodic effects have been thoroughly explored for one-dimensional mapping procedures, their role in higher dimensions is still unclear. By writing programs using Matlab software, we were able to explore the chaotic properties of the billiard system both graphically and analytically. Using techniques like Poincaré sections and Lyapunov exponents enabled us to examine the transition between chaos and classical behavior despite the challenges posed by a multidimensional phase space. Ultimately, our work hopes to verify the universality of scaling in chaotic systems with the calculation of a scaling constant for the fractal structures present in higher dimensions.

DESIGN OF A NOVEL RADIO TELESCOPE

Presenter
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This mentorship will eventually provide the IMSA community with a new resource that will enable them to study the universe from the perspective of radio waves. Currently, students can use optical telescopes to view the individual planets or stars, but nothing on a larger scale. By observing the differences in concentration of atomic hydrogen with the radiotelescope, students will be able to observe the structure of the Milky Way Galaxy, as well as nebulas or dust clouds. This information originates in atoms. Each element emits wavelengths of a different frequency, making it possible to distinguish them. We are interested in researching hydrogen, whose fingerprint marks the radio spectrum at 1.4 GHz. Using a symmetrical dish, the radio waves are focused into a point, which follows a path into a feedhorn. A probe sits at the antinode, a region of maximum amplitude, where the signal creates a current proportional to the intensity of the wave. The wave then travels to a low noise amplifier, where it is amplified. Thus, from atoms in the cosmos, IMSA students will be able to view the universe by looking at the concentration of atomic hydrogen.

WRITING AND EDITING "PORTRAITS OF GREAT AMERICAN SCIENTISTS II"

Presenters
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To explore and understand the process of editing and publishing professional writing, each student composed a chapter of a book. The book, "Portraits of Great American Scientists II," is a compilation of biographies based on background research and interviews with the scientists. The students involved in this Inquiry wrote about chemist Betty Harris, astrophysicist Margaret Geller, astronomer Wendy Freedman, and sociologist William Julius Wilson. Last year, the students prepared drafts of their chapters and interviewed the scientists. When examining how to incorporate the interviews into their drafts this year, the students realized the difficulty of editing an interview transcript into readable and authentic prose. In addition, the student authors had to write candid and thorough personal biographies while respecting for the scientists' privacy. The chapters were edited by internal and external advisors and underwent frequent revision. Three of the four chapters have been sent to the acquisitions editor of a publishing company. It is hoped that a contract will be forthcoming. The two-year process to produce this book demonstrated the diligence and patience required to create professional-quality work.

PROJECT READ

Presenter
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Mentor
Ms. Paula Altekruse, Illinois Mathematics and Science Academy, 1500 Sullivan Road, Enrollment Services, Aurora, IL, 60506; 630-907-5039; paula@imsa.edu

Our nation is faced with a literacy crisis. The No Child Left Behind Act of 2001 has mandated that at least 40% of students must read at the proficient level at the beginning of this accountability process and schools must ultimately maintain 100% proficiency by the year 2014. If schools do not meet the standard, they are placed on an academic warning list and receive sanctions, which can eventually lead to an administrative takeover of schools. Students are divided into five groups based on their reading levels. The groups focus on reading, comprehension, fluency, vocabulary, and math using print-out books, word puzzles, journals, and math problems. During the 2003-2004 school year, Project READ worked first semester with Nicholson School and second semester with Johnson Elementary. In 2002-2003, Nicholson had approximately 51% of students reading at the proficient level while Johnson Elementary was placed on the Illinois warning list for the first time with 57% proficiency. An after school program has been implemented at Johnson based on previous experiences at Nicholson School. The program has been named Club IMSA, and literacy activities are being piloted on "I" Days for 27 Johnson school students in grades 2-5.

FREE TRADE: A BETTER SYSTEM OF INTERNATIONAL ECONOMIC EXCHANGE?

Presenters
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Mentor
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Through our research this past year, we sought to determine the most holistically advantageous form of international trade. By researching different theories of international trade and learning about the history of previous trade methods, we attempted to determine whether free trade or bilateral trade agreements are more profitable for society as a whole. We investigated Milton Friedman's contention that free trade brings about free societies and ascertained the validity of this claim.

As part of our analysis, we studied the environmental, cultural, and political effects that different forms of international trade would bring about. While technologically advanced countries support forms of free trade, much friction exists between developing countries and systems of trade without economic barriers. Our findings over the year have allowed us to acquire a greater understanding of economic theory as well as the repercussions of economics upon other facets of society. We will filter the findings of our research through our newly acquired understanding of economics and present our conclusions.

THE LINAC COHERENT LIGHT SOURCE UNDULATOR TUNING

Presenter
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Mentor
Dr. Isaac Vasserman, Argonne National Laboratory, 9700 S. Cass Avenue, Argonne, IL, 60439; 630-252-9612; isaac@aps.anl.gov

The Linac Coherent Light Source (LCLS) at Stanford University will be the world's first x-ray laser which produces laser-like radiation flashes with a peak brightness 10 billion times greater and 1000 times shorter than any existing coherent x-ray light source (in the range of wavelength 1.5-15A). Undulator segments with a strong sinusodial magnetic field in the last 120 meters of the accelerator will direct and produce this radiation. At Argonne National Laboratory a prototype undulator was developed and meticulously tuned. Many approaches were taken to attain the proper magnetic field over the entire undulator line. This was a formidable task due to the tight tolerances for field stability (an allowed error of 1.5x10-4 Beff/Beff +-2 Gauss fluctuation in a field that is over 13,000 Gauss). The canted-pole-gap design in the end looks most promising and appears to be the best choice to proceed for fine adjustment of the effective magnetic field.

INHIBITING THE LONG TERMINAL REPEAT OF HIV-1: A SOLUTION TO AIDS

Presenter
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Reproduction of the type 1 human immunodeficiency virus (HIV-1) is directed by transcription from the viral long terminal repeat (LTR). Drugs called LTR inhibitors can block this process and stop HIV-1 from replicating. Two natural substances were tested as inhibitors: curcumin, an antioxidant and anti-inflammatory agent found in turmeric, and catalpa tree leaf extract which contains beta-lapachone, a drug currently being used in other HIV research. A DNA construct in which the LTR drives expression of beta-galactosidase was used as a noninfectious and safe reporter system. By means of transfection, the DNA construct was stably incorporated in to SupT1 cells, allowing the addition of substances to these cells to determine their usefulness as LTR inhibitors by measuring the amount of beta-glactosidase produced. Data and conclusions from this assay are pending. Preliminary data suggest some success in curcumin trials.

MAKING THE VIDEO

Presenters
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Advisor
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When we watch MTV of VH1 today, we see the visual accompaniments to our favorite songs. In almost all cases the music videos we see have messages that tie into the meaning of the song. Sometimes this meaning is apparent and sometimes it may be more subliminal. How do producers of music video decide on the role of the video in the interpretation of meaning? To what extent does the video track focus or distract the viewer from the song's narrative? We composed a song, then created and directed three different music videos with this question in mind. Viewer's responses were analyzed.

MUTATIONS OF THE NUCLEAR LAMINA AND DISEASE

Presenters
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Mentor
Dr. Elizabeth McNally, University of Chicago Hospital, 5741 S. Maryland Avenue, Chicago, IL, 60637; 773-702-2672; emcnally@medicine.bsd.uchicago.edu

Autosomal dominant mutations in LMNA have been associated with several distinct diseases including: autosomal dominant Emery-Dreifuss muscular dystrophy, dilated cardiomyopathy with conduction system defects (DCM), limb girdle muscular dystrophy, Dunnigan-type familial partial lipdoystrophy and Hutchinson-Gilford progeria syndrome. Despite lamin A/C's broad expression, mutations in lamin A/C render tissue specific phenotypes. Mutants in LMNA may preferentially disrupt tissue specific lamin A-protein interactions. In support of this hypothesis, the McNally lab has recently identified an inner nuclear membrane (INM) protein, nesprin-1a, which is highly expressed in striated muscle and binds directly to lamin A. It has been proposed that the nesprin-1a/lamin A interaction may be specific to striated muscle and may explain the tissue specificity of lamin A/C associated diseases. We investigated the interaction between lamin A/C and nesprin-1a and its role in the laminopathies in both wildtype and disease models using in vitro and cell culture models. We investigated whether point mutations in lamin A/C disrupt the lamin A/C/nesprin-1a interaction using a quantitative in vitro assay. Using myocyte culture and human tissue from a DCM patient, we studied the effect of mutant lamin A/C on the organization of the INM.

PROJECT IDAHO: INTERACTIVE TELEVISION

Presenter
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Mentor
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I have been involved in developing a new, interactive way of watching television. The system, known as Project Idaho, actively monitors the closed caption stream of the television program being watched and gathers related information. When the user indicates interest, the related information is dynamically formatted into a micro-website and displayed. News is a good example application of this technology. After hearing a short summary about a certain event, viewers often want more information. With the click of a button on their remote, the system instantly links them to related stories from various online newspapers, as well as detailed information about key players and details of the story.
Specifically, I have been responsible for the baseball section of Project Idaho. It provides live details of a game, statistics about players, weather at the stadium, and eventually even information about players the announcers mention. I am in the process of beginning work on a new genre of television programs as well.

CORRUPTION IN THE CITY THAT WORKED: CHICAGO AND THE RICHARD J. DALEY ADMINISTRATION

Presenter
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Advisor
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Beginning in the late nineteenth century and continuing well into the twentieth, big city political machines dominated urban politics. For many ordinary citizens the machine gave access to the halls of power even though it depended on extortion, misconduct, and dishonesty. Despite corruption, Chicago, under the leadership of Richard J. Daley (1955-76), "worked" at a time when the majority of cities deteriorated. Daley governed Chicago during one of its most substantial and consequential periods of change that included the immigration of thousands of Blacks and Hispanics and the flight to the suburbs of other groups. Examining interviews with politicians on several levels of the machine in the years following the death of the mayor provides qualitative evidence about the workings of the machine, while statistics like voting patterns, demographic changes, and municipal service delivery illuminate the effects of corruption on the city. Newspaper articles from the time period in question give information specific to events, scandals, and public opinion about the involvement of the machine in city government. Corruption provided immediate benefits for significant sectors of the population, but in the long term, the machine hurt even greater numbers of people and, more importantly, degraded the quality and integrity of the law.

THE EFFECTS OF AGGRENOX® ON CELLULAR ADHESION MOLECULE GENE EXPRESSION

Presenters
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Mentors
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Atherosclerosis is an inflammatory disease characterized by the accumulation of lipids and inflammatory cells in the arterial wall. The adhesion of white blood cells to the endothelium of the blood vessel plays an integral role in the development of atherosclerosis. ICAM-1 and VCAM-1 are two of the adhesion molecules that mediate the entry of particular white blood cells into the artery wall. Up-regulation of these inflammatory markers occurs through a redox-sensitive mechanism involving the redox-regulated transcription factor nuclear factor-kB. The buildup of oxidized low-density lipoproteins (ox-LDL) stimulates elevated expression of atherogenic gene products such as adhesion molecules. This study investigates the in vivo effects of Aggrenox®, a combination of aspirin and dipyridamole, compared with placebo on circulating ICAM-1 and VCAM-1 levels. We believe that Aggrenox® will have beneficial effects by lowering the levels of ICAM-1 and VCAM-1 gene expression based on its potency as an inhibitor of blood clotting in the vessel. Furthermore, dipyridamole's antioxidant properties suggest that treatment would lower the amount of LDL oxidation and therefore lower the amount of adhesion molecule gene expression. Studies have shown dipyridamole's ability to scavenge both oxygen radicals and hydroxyl radicals, as well as to reduce peroxidation and oxidative modification of LDL. Lower levels of adhesion molecules would inhibit the bonding of white blood cells to the site of the lesion. Analysis of data from this study may provide further clarification of the atherosclerotic pathway and the effectiveness of Aggrenox® as a treatment for atherosclerosis.

FISH SKINS AS A NOVEL SOURCE OF BLOOD ANTICOAGULANT PHARMACEUTICALS CONVERSION OF WASTE TO AN ECONOMIC, VALUE—ADDED PRODUCT FOR MEDICAL USE

Presenter
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Mentors
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Heparin and low molecular weight heparin (LMWH) are the most widely used anticoagulant drugs. Both heparin and LMWH bind to the natural inhibitor antithrombin III, which then binds many coagulation factors that relate to thrombin generation, inhibiting blood clot formation. Because of the diminishing supply of heparin, alternative sources are being sought. The aim of this project is to investigate a novel source of heparin from fish skins. Initially an anticoagulant test panel consisting of the APTT, PT, HepTest, Thrombin Time, anti-factor Xa, and anti-factor IIa (anti-thrombin) assays was run on clinical grade porcine heparin and the LMWH enoxaparin. These tests measure the inhibition of blood clotting by heparin at different parts of the coagulation cascade. The results from heparin and LMWH will be used as a standard that the fish heparin will be compared to. Electrophoresis of glycosaminoglycan (GAG) mixtures isolated from tuna fish skin showed that heparin was present. The anticoagulant test panel for the fish heparin showed anticoagulant activity in proportion to the amount of heparin detected, although activities were lower than what was observed for porcine heparin. Our findings suggest that fish skins, which are normally discarded, may be used as an alternate source for heparin.

UNDERSTANDING THE BASIS OF NEURODEGENERATION: LANP AND SPINOCEREBELLAR ATAXIA TYPE 1

Presenters
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Mentors
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Neurodegenerative diseases affect the brain and neurons in the human body . The one of interest to us is called Spinocerebellar Ataxia Type 1 (SCA1), a disease characterized by cerebellar dysfunction. SCA1 belongs to a family of disorders where there is a polyglutamine repeat in the relevant disease causing protein. The cause of the disease is still unclear. The protein encoded by the SCA1 gene is ataxin-1. We know that ataxin-1 interacts with leucine-rich acidic nuclear protein (LANP); and therefore either binds to ataxin-1 and depletes it, or they become toxic and have been thought to be important in neuronal degeneration. LANP has several interesting features; one of which is its ability to bind to microtubule-associated proteins (MAPs) and tau. Using a biochemical approach, we want to replicate the LANP – tau interaction in vitro, and subsequently, in vivo; along with investigating LANP/tau interaction in other neurodegenerative diseases such as Alzheimer's.

FILLING IN THE GAP: AN ANALYSIS OF THE EDUCATIONAL ACHIEVEMENT GAP BETWEEN AFRICAN AMERICANS AND CAUCASIANS

Presenters
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A great disparity exists between the academic achievement of Caucasians and African Americans, with African Americans often underachieving. Speculation, as well as analysis, suggests that many factors have contributed to this achievement gap. For example, socioeconomic differences play a role in that even though students who come from affluent areas tend to have a smaller achievement gap difference than those from less affluent areas, the achievement gap is far from being eliminated. Parental influence has an impact in that those parents who are involved in their child's education tend to help reduce the gap for their children. Lack of school resources, such as underqualified teachers , increases the achievement gap because opportunities are limited and are of poorer quality. The experiences that a student has in the non-school environment also play a large role in how students value education. Finally, the images and messages that are portrayed in the media significantly influence a student's belief about him/herself and their ability to be successful in school. Our project makes suggestions for reducing the educational achievement gap between Caucasians and African Americans by meaningfully addressing the factors listed above.

MULTIPLE ANTIBIOTIC RESISTANCE ASSOCIATED WITH BRANCHED CELL MORPHOLOGY IN ESCHERICHIA COLI

Presenter
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Advisor
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E. coli can develop resistance to antibiotics in response to sublethal treatment. E. coli (ATCC# 9637) has a minimum inhibitory concentration (MIC) for ampicillin of 30 g/ml. Through repeated exposure, E. coli strain SG-1 was developed, which has ampicillin resistance to an MIC level of 1000 g/ml. Kirby Bauer testing was completed comparing the parent strain 9637 and the SG-1 strain against susceptibility to other antibiotics. Results show that SG-1 is more resistant to other antibiotics (cephalothin, tetracycline, trimethoprim, nalixic acid, and streptomycin) than E. coli 9637. SG-1 displayed branched cell morphology consistent with changes in the penicillin binding protein involvement in cell wall synthesis and shows a decreased growth rate as compared to the parent strain. Work is currently underway to transform DNA from SG-1 into a new bacterium in an attempt to isolate a genetic basis for this trait. If scientists can determine what causes changes and resistance, it should help to stop antibiotic resistance.

COLORING FINITE ABELIAN GROUPS TO AVOID MONOCHROMATIC TRIPLES WHOSE SUM IS 0

Presenter
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Mentor
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In this paper, we consider a Ramsey-type question on finite Abelian groups. We wish to color the finite Abelian group G in such a way that for all triples of distinct elements x,y,z in G of the same color, x+y+z is not 0. Let \chi(G), the chromatic number of G, be the minimum number of colors permitting such a coloring. We give a full characterization of those classes of finite Abelian groups G which have the property \chi(G) is bounded; it turns out that for a class F of finite Abelian groups, \chi(G) is bounded if and only if both the 2=ranks and the 3=ranks of the groups in F are bounded. We give explicit lower and upper bounds on \chi(G) in terms of the 2-rank and the 3-rank of G.

EFFECTS OF MCF-7 AND ZR-75-1 BREAST CANCER CELLS ON THE GROWTH PATTERNS OF ENDOTHELIAL CELLS

Presenter
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Angiogenesis, the growth of new blood vessels, is a crucial part of tumor development. Endothelial cells are especially important to the process because they act as the precursor to blood vessel formation and are among the first for which proliferation due to angiogenesis occurs. In order to distinguish the effects of the breast cancer tissue on these cells, in vitro cultures were grown. Endothelial cells (HUV-EC) were cultured with a combination of growth medium and breast cancer cell supernatant. Some cultures were also grown with a professionally made media additive, ECGS, which mimics angiogenic signals in vitro. Cells were considered healthiest when they were able to maintain a high level of proliferation for the longest period of time. Results showed that higher concentrations of breast cancer cell supernatant were needed to obtain this growth when ECGS was absent as compared to when ECGS was present. This led to the conclusion that breast cancer cell supernatant contains some growth promoting factors that work synergistically with the purchased supplement. Further experimentation to understand these changes in the physical characteristics of endothelial cells could offer information about how messages pertaining to angiogenesis are received and translated.

STARING ACROSS TWILIGHT: WRITING A SCIENCE FICTION NOVEL

Presenters
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Last year our Inquiry focused on writing a science fiction novel through a collaborative effort. This year we focused less on the collaborative aspect of the project and more on the writing process itself. We have found that the writing process proved to be more complicated this year as the plot became more intricate. The second arc has turned out to be much more of a political drama than the first arc, which was almost a pure action sequence. We have learned that this style of writing is considerably more difficult than writing action, which flows much more naturally for us. In the sort of political arena that our novel describes, it is very important to consider all the possible viewpoints of the various political groups that we have written about. Our collaboration is proceeding smoothly, although having two authors will inevitably lead to conflicting opinions. However, the benefits reaped from such an undertaking are well worth the slower pacing; each of us can often see plot potential and story hooks when the other cannot. Currently, we feel that our novel is about halfway written, with additional editing yet to be accomplished.

ANTIMICROBIAL SYNERGY STUDIES OF METHACILLIN RESISTANT STAPHYLOCOCCUS AUREUS USING VANCOMYCIN AND RIFAMPIN COMBINATIONS WITH OR WITHOUT SUB-INHIBITORY GENTAMICIN

Presenters
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Mentor
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The objective of this project was to examine the disconnect between combined vancomycin/rifampin minimum inhibitory concentration (MIC) and minimum bactericidal concentration (MBC) values observed in clinical in vitro testing against Staphylococcus aureus. Micro dilution methods that have been universally agreed upon were used to identify the MICs and MBCs of these antibiotics alone and in various arrangements according to concentration. Drug combinations were then determined to be indifferent (showing negligible/no MIC/MBC change), additive (demonstrating minor advantageous change), synergistic (showing significantly beneficial change), or antagonistic (demonstrating disadvantageous change) for each study. Gentamicin was added at sub-inhibitory concentrations to the drug array to see whether it would help to lower the synergy MBCs, and thus lessen the MIC/MBC disconnect. It was found that although the addition of gentamicin at sub-inhibitory concentrations did not significantly impact the MICs of rifampin and vancomycin, the gap between the MICs and MBCs was dramatically narrowed as the concentrations of gentamicin were increased. Based on these preliminary synergy studies, it can be concluded that small amounts of gentamicin may assist rifampin and vancomycin in treating acute staphylococcal infections.

A CHANGING WORLD AROUND US

Presenter
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Mentor
Ms. Joy Meek, Wheeler Kearns Architects, 343 South Dearborn Street #200, Chicago, IL, 60604; 312-939-7784 x109; joy@wkarc.com

The process of creating architecture includes many disciplines in science, math, art, and listening, empathy for people who are the end uses of what architects create. My mentorship investigation focused on the process of construction for residential projects and the different types of construction. Each project is a study of different styles and each type of construction.

In this presentation, precedent architects and projects are studied on how they helped promote structural design in wood, masonry, steel and glass constructions. In addition to that, there will be a model of a vacation family home, a brief discussion of a site visited, and a comparison between The Robie House designed by Frank Lloyd Wright and The Farnsworth House designed by Mies van der Rohe. This lecture will be in a form of a power point presentation with handouts for guests to follow.

SYNTHESIS AND PROPERTIES OF A NOVEL ORGANIC COMPOUND: 1-CHOLESTERYL 3', 5' –DI-O-TOLUOYL-2'-DEOXYRIBOSIDE

Presenters
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Mentor
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Our objective was to synthesize1-cholesteryl 3', 5' –di-O-toluoyl-2'-deoxyriboside, a cholesteryl deoxyriboside. It can potentially inhibit cholesterol esterase, an enzyme. Cholesteryl bromide was heated with magnesium and iodine in tetrahydrofuran for one hour at 40° C to form a Grignard Reagent. Next chloro-3', 5'-di-O-toluoyl-2'-deoxyribose was added. The mixture was stirred overnight, then extracted with ammonium chloride and sodium bicarbonate, then extracted with methylene chloride and evaporated to a small volume using a rotary evaporator. We separated suspected compounds using silica gel thin layer chromatography (TLC) and hexanes:ethyl acetate(9:1). Two UV absorbing bands were found – one of which could be our product. The two bands were obtained by scrapping the silica gel off of the TLC plates, extraction of the powders with methylene chloride and evaporation to dryness. Currently the research team is attempting with the aid of Dr. Eric Kool to determine their structure. One member of the team is attempting to perfect an assay system for cholesterol esterase. Cholesterol esterase hydrolyzes cholesterol esters such as cholesterol oleate to cholesterol and oleic acid. We are studying the inhibition of this enzyme using various substances while awaiting the isolation and identification of the cholesteryl deoxyriboside.

DISSOCIATION OF MCF-7 BREAST CANCER CELLS WITH DIFFERENT CONCENTRATIONS OF EDTA

Presenter
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Advisor
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Trypsin is commonly used to dissociate cells in culture from their substrate. Previous experiments with cultured MCF-7 cells (a breast cancer cell line) showed that they do not dissociate when trypsin is added. In order to test whether calcium-dependent cell adhesion was responsible for clumping in MCF-7 breast cancer cells, I added different amounts of EDTA, which removes divalent cations such as Ca^{++} and Mg^{++}, along with trypsin. MCF-7 cells were cultured until confluent. Then 41.5 mM to 83.3 mM EDTA was added, along with 20% trypsin. After thirty minutes of agitation on the shaker, there seemed to be no difference in clumping; slight variations in the structure might have occurred, but the same strong adhesion of the cells showed that significant changes never resulted. This indicates that either the concentration of EDTA was too low or something other than calcium-dependent adhesion was responsible for clumping in MCF-7 breast cancer cells.

IMSA SPANISH STUDENT HANDBOOK

Presenters
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Have you ever read the IMSA Parent/Student Handbook? Not only did we read the handbook, which was hard enough to comprehend in English, but we have also been translating it into Spanish for several months. According to the Census Bureau, in the year 2000, 19.2% of families in Illinois spoke a language other than English in their home. This statistic, along with the fact that some students of Spanish-speaking families are not able to discuss IMSA policies with their children, led us to our inquiry project. Throughout this school year we have learned much about the process of translating text from our advisor and from our own experience, which we have developed over the course of our Spanish education. English is a very difficult language to translate because of its idioms and non-translatable words and phrases. However, this problem led us to gain a better understanding of the handbook material before attempting to translate it. Discipline policies, sections concerning Residential Life, and visitation guidelines were considered to be top priority for both prospective and current IMSA parents, so we translated them first.

PREDICTING AND INTEGRATING WORDS IN SENTENCES: AN FMRI INVESTIGATION

Presenter
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Mentors
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During sentence comprehension, people must integrate the meanings of individual words in order to understand what the sentence means as a whole. There are several factors that may influence how easy it is to integrate words within a sentence, including semantic relatedness, grammatical structure, and message level meaning, all of which are reflected by sentence predictability. Previous research has demonstrated that words are recognized more quickly when they appear in predictable sentences. Thus, predictability can be used as a measure of the ease of word integration. This project explores what areas of the brain may be more active during the process of integrating upcoming words within sentences. We measured blood flow to areas of the brain using functional magnetic resonance imaging (FMRI) as an indication of neural activity. The comparison of blood flow between low and high predictability sentences showed significant activation in certain cerebral areas, including the inferior frontal gyrus, which was more active for low predictability sentences. We conclude that because low predictability sentences consider a wider range of words, it is harder to integrate and select words in those contexts. Hence, the inferior frontal gyrus appears to be important for integrating and selecting words during sentence comprehension.

CORPUS DELECTI: PROJECT "TOO GOOD"

Presenters
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Lauren Jarocha, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL, 60506; myst013@imsa.edu

Mentor
Dr. Anne Grauer, Loyola University, Department of Sociology and Anthropology, 6525 N. Sheridan Rd, Chicago, IL, 60626; 773-508-3464; 773-508-3480; agrauer@luc.edu

In September we undertook a project called "Too Good" under the guidance of Dr. Anne Grauer, a biological anthropologist at Loyola University Chicago. This project consisted of cleaning, numbering, and identifying over 2000 pieces of human bone discovered at an archaeological site (called the Too Good Site) near Elgin, Illinois. The recovered bones range in size from the entire femur to fragments the size of nail clippings. Over the course of two semesters we attempted to anatomically identify the bones in the collection, focusing on what part of the body it came from; the side, if applicable; the fragment segment, if a long bone; age at death; sex; and pathology.

The collection consists of multiple individuals of varying ages. There is at least one juvenile individual represented in the group, evident from epiphyses (areas of growth and fusion). Older individuals have been discovered with distinguishing characteristics such as arthritis. Our goal is to identify all bone fragments, catalogue and evaluate them to determine minimum number of individuals present in this collection, and to acquire any other available information pertaining to these individuals.

VOICE RECOGNITION IN THE NAVIGATION SETTING

Presenter
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Mentors
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Currently, Navigation Technologies is seeking ways to implement automatic voice recognition (ASR) in the car navigation setting so that the entry of an address or a Point of Interest (POI) can be made via human voice. The system would decipher the voice and convert it to the appropriate destination. Voice-enabled navigation allows drivers to concentrate on the road ahead and less so on operating the navigation system.

Approaches to ASR speech recognition include a combination of cohesive data and hierarchical process. The voice recognition process includes feature extraction, probability estimation, decoding, and the usage of language models to understand the meaning of the voice input. The system , which includes a speech engine, accepts voice input provided by the user and matches each wave file created from the voice input to a specific phonetic string of many stored in the database. At present, research is being done to improve speech recognition systems. Such research includes: 1) improving the speech system's robustness against noise 2) improving language models to accommodate larger vocabularies and 3) increasing the number of languages understood by the system to render a viable application for drivers.

ARCHAEOLOGY: EXCAVATION OF A ONE-ROOM SCHOOLHOUSE

Presenters

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Mentor

Mr. David Gossman, 45W962 Plank Road, Hampshire, IL, 60140; 847-683-2582; dgossman @gcisolutions.com

The archaeology team has devoted several semesters to the research and excavation of the Buck Creek Schoolhouse, a one-room schoolhouse in Zwingle, Iowa. Through fieldwork and research, we were able to generate a clear picture of what life was like at the Buck Creek Schoolhouse. Research includes working with the local historical society to find any existing records of the schoolhouse, conducting interviews with residents who may have had family members attending the school to procure a more personal account of the school's history, general excavation technique research to perfect our excavation and artifact retrieval/classification abilities, and investigation into the history and origins of the artifacts that we have found, providing us with an idea of the school's logistics. We were able to construct a scale model of the schoolhouse's foundation based on a combination of researching common one-room schoolhouse architecture in the Midwest during the time period that we believed our school was in operation 1863 along with examination and interpretation of the structural remains that were excavated.

NO TOLERANCE FOR ZERO TOLERANCE

Presenters

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Conan Liu, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL, 60506; chinkiee@imsa.edu

Mentors

Dr. Lauren Girard Adams, Northwestern University School of Law, 357 East Chicago Avenue, Chicago, IL, 60611-3069; 312-503-1841; l-adams@law.northwestern.edu

Dr. Aracely Muñoz Contreras, Northwestern University School of Law, 111 W. Jackson Blvd. Suite 300, Chicago, IL, 60604-3502; 312-347-8371; amc_cfjc@hotmail.com

The Zero-Tolerance Policy has been forged as a result of unethical jurisdiction, affecting all adolescents in school by punishing every act of misconduct with the same level of severity. In most cases in the Chicago Public School (CPS) system, students that are accused of breaking any school rules, whether it be pushing a teacher or stealing a classmate's shoes, are suspended or expelled. There have even been incidences where sharing a cough drop or lending an inhaler have led to expulsion. Ultimately, this policy enforces and encourages unfair treatment for the students. In an effort to exonerate those that were and those that are continuously and unfairly being treated by the system, we are investigating the roots, origins, and preventative measures we can take in order to alter this unjust policy. By analyzing police reports that are filed and communicating with CPS students that are currently affected by the policy, we are investigating trends and patters that the system enforces, recognizing specific ethnic, sectional, and socio-economic communities that are directly affected by this policy. We don't want to eradicate the policy altogether. However, drastic changes need to be made to the policy to ensure justice and equality for all students.

A BROTHERS' WAR: JOSEPH, WILLIAM, JAMES, AND SAMUEL MEDILL

Presenter
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Advisor
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Prior to and during the Civil War, the Chicago Tribune's Joseph Medill exercised his rights to use his paper to influence others in such a way that he became a key cause of the war. In a different way, his brothers, William, James, and Samuel Medill stood up for these same beliefs by fighting and, for the eldest, dying for the Union army. Despite this great, but horrific honor, their big brother, Joseph, remains the one with all the glory, while they only have a small shrine in the family home of Cantigny. Battle reports, newspaper articles of the time, and other sources have shed light on the lives of all the Medill brothers. For one, coming from a wealthy family, William could have easily paid someone to join the Union army in his place. Yet, he chose to take the responsibility on himself and ended up fighting in the front lines of the decisive battle of Gettysburg. Although some historians argue that the so-called hypocritical Yankees sacrificed little for their beliefs, these men represent those who went as far as to choose to die for the cause.

CELLS THAT ARE ABLE TO SUPPRESS APOPTOSIS HAVE THE POTENTIAL TO BECOME LEUKEMOGENIC

Presenter
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Mentor
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In this study, it was proposed that the regulated process of apoptosis may be pro-actively involved in initiating certain forms of cancer. Within this aspect of apoptosis, failure of execution leads to cell survival with inherited genetic change. In the normal pathway, human and animal cells are signaled by the caspases to undergo DNA degradation. Irradiation is one type of apoptosis initiator. We irradiated TK6 cells and observed the effect of two variables: amount of dose applied and amount of elapsed time after irradiation. Results showed that apoptotic activity increases with both amount of dose and elapsed time. Within this apoptotic process, the gene modified is the MLL (Mixed Linkage Leukemia) gene. It is the transcription and translation of this fusion gene that is able to drive the leukemic process. For this to be possible, such cells have to escape from apoptosis. We hypothesized that IAP (Inhibitor of Apoptosis) genes such as XIAP aid in their survival by suppressing caspase function. By comparing protein expression of an empty plasmid and a plasmid containing the XIAP, we tested its ability to suppress translocations and better understand the role of apoptotic effectors on the generation of translocations such as the MLL.

MODERN WEB-BASED BUSINESS: LESSONS LEARNED FROM THE CRASH

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Advisor
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Internet based business has grown rapidly over the last decade, even though it suffered a setback during the dot com collapse in 2000. This inquiry serves as an investigation of this growth and the lessons learned from the crash. Through case studies of both failed and successful web-based businesses, and a look at modern literature on the subject, one can gain a solid grasp of what is truly needed to put together a successful business model for the web, and what mistakes were made before the collapse. One of the biggest mistakes made by the dot coms was an overestimation of the value of branding. Another common mistake was a vast overestimation of the growth of the internet and its connected customer bases. The businesses that did mange to pull through the crash can attribute their success to more realistic business goals and conservative spending. The companies that survived were the ones that planned well from the start or were willing to downsize appropriately when the failure of their old business model became apparent. Specific case studies, including Google, Amazon, and a host of now forgotten failed companies, are examined, and the good, bad, and ugly of the online business world is brought to light.

PORTRAITS OF GREAT AMERICAN SCIENTISTS II

Presenters
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The goal of our inquiry project is to learn about the editing and publishing process by composing scientific biographies that will appear as chapters in a book written by IMSA students. Our book, entitled "Portraits of Great American Scientists II," is aimed towards audiences of all ages. With this book we hope educate and excite others about the great scientists of our generation and their vast achievements that are changing our world. Publishing a biography is a tedious process consisting of researching, drafting, writing, editing, and finally, publication. Over the past year and a half, we have completed extensive drafts that have been through many edits. Interviews with our individual scientists helped us to gather accurate information and quotations. After a final review, we sent our chapters our publisher. Currently, an acquisitions editor at a publishing house is reviewing our work. In the near future, we will send our completed drafts to our scientists for revisions as well. The final copy will then be sent to the publisher. We also anticipate having a conference interview with the publishing company to understand the steps they will take to publish our biographies

HOMEOPATHIC REMEDIES VS. THE PLACEBO EFFECT

Presenter
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Advisor
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This inquiry investigation examined the effectiveness of homeopathic remedies by examining and analyzing the literature. The peer-reviewed literature showed that homeopathy is a form of alternative medicine that follows the idea of Sililia Similibus Curentur, meaning like cures like. In homeopathic procedures, a specific medicine is given to a sick person because it is capable of producing a similar state when given to a healthy person. In most double blind clinical studies, the homeopathic remedies are generally more effective than placebos, however, the more rigorous the experimental conditions, the less effective the remedies. In vitro experiments were also performed to determine whether an extract of *Calendula officinalis*, a remedy used to treat cuts, stimulated the growth of B cells in tissue culture. Actively growing cells were plated in solutions of 0%, 6.25%, 12.5%, 25%, and 50% Calendula extract. The most diluted of the remedies showed the greatest cell stimulation. This data, however, did not show more rapid cell growth compared to the control. This is most likely the result of the alcohol already existing in the Calendula extract. To better understand these results, more tests on the effects of alcohol on cell regeneration will need to be performed.

A BOTANICAL SURVEY

Presenters
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Our botanical survey began in 1999 on the Gossman farm in Zwingle, Iowa, and will continue until our final goal of collecting three samples of each species on the farm is met. The objective of having multiple specimens of each species is to send one copy to the Iowa State Herbarium and another to the IMSA Herbarium while keeping a third set at the Gossman farm. A botanical survey documents plant life by providing a dried specimen of a plant as viewed from both sides, including its leaves, stem, flower, root structure, and seeds. In addition to the specimen, careful notes on location and special features as well as photographic documentation are taken upon collection. After collecting and mounting samples, the finished specimens are identified using a dichotomous key. This year in addition to conducting the botanical survey we sought the counsel of a trained, professional botanist, Dr. Neese. Upon reviewing our techniques involved in identifying and displaying specimens she found many mistakes in our specimens collected in years past. She helped us out by teaching us the correct ways to identify plants. We then made the decision to dedicate the entirety of the winter portion of our mentorship to correcting these mistakes. Along with this we are also classifying the plants we collected this summer. To start off this process we examined our list of specimens. As of right now we are in the middle of finishing this up so we can get a fresh start this spring. The farm includes a diverse population of vascular plants, which are the focus of our survey. Privately owned by our mentor David Gossman, this land has never before been surveyed.

A SEARCH FOR CALCIUM, ALUMINUM-RICH INCLUSIONS (CAIS) IN CARBONACEOUS RENAZZO-LIKE CHONDRITES

Presenter
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Mentors
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The solar system formed as a result of vaporized elements cooling and condensing to form solids. From thermodynamic calculations for the cooling of the solar nebula, the first solids to form in the solar system should be Calcium, Aluminum-rich Inclusions (CAIs). Such objects can be found in some meteorites. We are studying a type of meteorite, a carbonaceous chondrite, that never melted and contains these calcium, aluminum-rich mineral assemblages that formed very early in the history of the solar system, 4.5 billion years ago.

Employing a freeze-thaw technique aimed at separating inclusions from the forsterite- olivine matrix, we have successfully disaggregated what appears to be under 5% of the original 10 gram sample. We examined the loose grains under a microscope and selected minerals and inclusions of interest for further study. We are currently analyzing the inclusions with a Scanning Electron Microscope (SEM). By sampling the meteorite in this way we hope to find CAIs and other new objects that might render insight to the formation of the solar system.

RECURRENCE QUANTIFICATIONS OF PROTEINS AS SMALL-WORLD NETWORKS

Presenter
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Mentor
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Proteins have the ability to bind to other proteins and DNA molecules to regulate cellular functions. The number of contacts possible between proteins varies widely in the community of proteins. It has recently been demonstrated that proteins form small-world networks which are to be distinguished from random networks and nearest-neighbor networks. Small-world networks (e.g. the internet) have the ability to transmit large amounts of information efficiently in time and space. We examined a large data set of 1,700 proteins which enumerates specific protein-protein interactions in the yeast *Saccharomyces cerevisiae*. We found that there was a strong inverse relationship between the number of yeast proteins and the number of contacts they form. We hypothesized that the few proteins forming many contacts (10-15; type A) had different recurrent structuring than the many proteins forming few contacts (1-5; type B). Recurrence quantification analysis (RQA) was performed on amino acid sequences of individual proteins (homepages.luc.edu/~cwebber/). The results confirmed that proteins with differing numbers of contacts could be distinguished by their specific recurrence variables. We conclude that the recurrence patterns of proteins are suggestive of the major (type A) or minor (type B) roles proteins play in their small-world networking.

CHARACTERIZATION OF THE EXPRESSION PATTERN OF THE FIBRILLIN3 GENE IN HUMANS

Presenter
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Mentor
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The Fibrillin3 gene, or FBN3, is a connective tissue protein which provides strength and elasticity. It is a fibril forming glycoprotein that is the main component of extracellular microfibrils, which are one constituent of elastic fibers. FBN3 maps to Chromosome 19p13.3 (chr19p13 .3), a locus that has recently been found to be associated with the Polycystic Ovary Syndrome (PCOS) susceptibility gene. Chromosome 19p13.3 is also the gene that contains the PCOS associated marker, D142884. The function of the FBN3 gene is currently not known, and it is also not known whether the gene is expressed in human tissues. The aim of our research lies in exploring the potential function of the gene, including its expression profile in humans. Scientists have found that the FBN3 gene is not expressed in mice, but further research, including our own, has shown that FBN3 is expressed in humans. We were able to find over the course of our investigation that the FBN3 gene is most commonly expressed in the tissues of the brain/cerebellum, fetal brain, kidney, salivary gland, skeletal muscle, testis, adult ovary, and adult skin. Our research has shown that the FBN3 mRNA is expressed in multiple human tissues as such it is a much more promising susceptibility gene for PCOS than is a putative gene mapping a given chromosomal location.

ENGINEERING VESICULAR POLYMERIC PRODRUGS FOR ORAL DRUG DELIVERY

Presenter
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Mentor
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Therapeutic molecules, such as anti-psychotic drugs, may have toxic effects on the body because they work on the entire body, not just the area of interest. With a system that would provide for a release of the drug for an extended period of days to weeks, patients would benefit greatly from the accurate and targeted release of the drug. Polymeric micelles prepared from amphiphilic block copolymers have sparked much interest as potential drug carriers. The objective of this research was to synthesize and characterize biodegradeable, polymersomes, liposome-like, tough vesicles, of terpolymers of poly(ethylene glycol-b-(lactic acid), which is a block copolymer that consists of methoxypoly(ethylene glycol) (PEG) and poly(lactic acid) (PLA) conjugated with the model drug of haloperidol, or Haldol, an anti-psychotic drug. Using light scattering spectroscopy, the efficiencies between polymersomes with conjugated drug and polymersomes with free drug were compared.

AMERICA'S ANTI-COMMUNIST AGENDA AND KOREA, 1945-1950

Presenter
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After the U.S. victory against the Japanese in WWII, Americans were left to reestablish Korea, a country that was torn apart by years of Japanese imperialism. However, in addition to cultural barriers, Americans faced a country that was in danger of becoming communist not only because China bordered Korea, but also because Korea above the thirty-eighth parallel was in Soviet control. Through research, it has been found that the U.S. made extensive efforts to establish a democracy in Korea. One common tactic was to use military force. Such forces, however, involved the death of hundreds of civilians. Other American efforts involved the disbanding of local Korean governments and the establishment of an American-influenced government. According to narratives by Koreans who survived the Korean War, it is known that propaganda campaigns involving both Americans and Koreans used to exist. Unfortunately, written documentation of this has been difficult to obtain. In the end, however, only half of Korea avoided communism while the other half is now labeled a dangerous communist state.

THE BIODEGRADIBILITY OF A CORN PROTEIN POLYMER

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As conventional plastics are persistent in the environment, improperly disposed plastic materials are a significant source of environmental pollution. It has been discovered that starch-based plastics are better for the environment in that traditional plastics can take more than fifty years to decompose naturally, where as a starch-based plastic will biodegrade ten to twenty times faster. In this project, small blocks were created out of zein (corn gluten) to test the biodegradability of corn protein based polymers. Identical in shape and size, each block was closely monitored in moist soil kept at room temperature to measure the progress of biodegradability of the substance. Results were found based on reduction of mass by unearthing 2-3 blocks per week for a period of 4-6 weeks. These results suggest that zein polymers are an effective biodegradable substance. The future for biodegradable plastics is very promising as many everyday items could easily be replaced with more environment-friendly products.

WOMEN OF THE NIGHT: THE UNTOLD STORY OF FEMALE ASTRONOMERS

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Dr. Lucy Fortson, Adler Planetarium, 1300 S. Lake Shore Drive, Chicago, IL, 60605-2403; 312-322-0338; lfortson@adlernet.org

Gender bias and discrimination against women in science can take many forms, from overt sexual harassment to the much more common problem of subtle and unconscious sexism. For my inquiry project, I interviewed four prominent women astronomers from the Adler Planetarium and the University of Chicago to further understand the obstacles they have overcome in their careers. These scientists have dealt with gender bias from both their teachers and colleagues and learned to juggle their careers and families, while still managing to make a name for themselves in the field of astronomy. By combining footage of the women going about their daily lives with voice-overs from the interviews and archival material they've provided, I've created two prototype biographies of Dr. Lucy Fortson and Dr. Grace Wolf-Chase. These short biographies provide firsthand insight into the arduous process women astronomers must undertake when trying to succeed in a male-dominated field, as well as the rewards that come out of this struggle. My hope is that this documentary will inspire and motivate young girls to actively pursue their interest in science by providing them with stories of other women who have faced the odds and succeeded.

BILE SALTS AND CHOLESTEROL NUCLEATION

Presenter
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Mentor
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Gallstone disease – a widespread human disease that involves crystallization of cholesterol – is caused by accumulation of macroscopic cholesterol crystals that precipitate from biliary vesicles (50-100 nm in diameter). Vesicles, in which cholesterol resides, are thermodynamically unstable, and cholesterol eventually precipitates from the vesicle when equilibrium is obtained. However, humans are not at equilibrium, and the question of who develops gallstones depends heavily on the rate at which cholesterol leaves vesicles to yield crystals; several chemical species in bile are known to influence this rate. The objective of this research was to examine the process by which cholesterol crystals form in a model bile system. Synthetic vesicles exposed to bile salts NaTDC, NaTUDC, and NaTC were examined. Using dynamic light scattering and UV spectroscopy, the micro-structural transition from vesicles to micelles was observed. Four distinct zones characterized this transition, depending on the bile salt concentration, giving rise to varying levels of vesicle aggregation and micellization. No significant correlation was seen between the interaction of vesicles with these various bile salts.

ZINN - ZINN IS NOT NOTES

Presenters
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Project ZINN is a collaborative effort by members of the IMSA community to develop a replacement for the current aging IMSA notesfiles message board system. After researching various ideas, a client/server architecture was chosen. The client/server communication protocol, was designed as an extensible framework built upon existing Remote Pocedure Call methods. Unlike the current notesfiles system, where the notes reader had to be located on the same computer system with the database files containing the posted messages, ZINN's client/server architecture allows the notes reader to be located half-way around the world from the ZINN server managing and storing the messages on the system. The reference implementation of the ZINN server (znotesd) is designed to be flexible, fast and secure. RPC wrappers (around the protocol functions) and database wrappers, by way of OO-style interface/implementation and shared object loading, allow the server to use any RPC interface (DCOM, DCE, SOAP, CORBA ...) and any database, provided the necessary wrapper has been written. The wrappers provided with the reference implementation will use XML-RPC/SSL and MySQL. The reference implementation of ZINN clients will provide (subject to change) PHP (web-based), VB, C# and native BSD/Linux clients.

BIODIESEL: FUEL OF THE FUTURE

Presenters
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This investigation explores the various components that go into making biodiesel and their relationships within a biofuel. Our goal for this inquiry was to optimize the fuel from both an economical and scientific perspective. The biodiesel fuel was created from vegetable oil and alcohol, with the reaction catalyzed by sodium hydroxide or potassium hydroxide, a strong base. Initial trials using 0.35g catalyst, 20ml alcohol, and 100ml vegetable oil were unsuccessful because the glycerin and biodiesel did not separate correctly, which is necessary for the fuel to be utilized. The amount of catalyst will be altered experimentally in order to create the best ratio of reactants to catalyst. Once the optimal ratio is determined, we will test our biodiesel products with a bomb calorimeter that determines energy output. Economy is dependant on price and availability of the materials. When produced in small batches, biodiesel is quite expensive when compared to oil. However, when created in large quantities it would be only slightly more expensive than oil and would provide a renewable fuel source. When our research and experimentation is complete, we will be able to determine if biodiesel is practical as a fuel of the future and if so, which type is best.

SHORT-TERM WEATHER FORECASTING USING MODELING SOFTWARE

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Mentor
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Weather forecasting is an aspect of science that directly affects everyone's daily lives. However, the meteorologist's task is not as easy as it seems. Meteorological models give an idea of what the atmosphere will look like at a certain point in time for a certain geographical area . However, models are far from giving us detailed forecasts. It is the meteorologist's job to put the pieces together by looking at maps, soundings, and models and hopefully assemble a correct forecast. For the most part, we have been using the ETA and GFS models put out by the National Weather Service. These two models provide the raw data from which complete forecasts are made. Among this data are the wind speed and direction, temperature, humidity, precipitation type and amount, and vorticity. By looking at this data in both numerical and visual (map) form, we have been able to construct usually accurate local forecasts for the Chicago area over the past several months.

ENVIRONMENTAL TRIGGERS OF CEREBRAL ANEURYSMS

Presenter
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Advisor
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To create a further understanding of familial cerebral aneurysms and to determine if there are environmental triggers, I gathered information from articles written on this topic. From reviewing the articles, I discovered that many factors exist that may increase a person's chance of acquiring cerebral aneurysms. Such causes include genetic factors and acquired factors. Genetic factors that have shown to increase the occurrence of cerebral aneurysms include Ehlers-Danlos Type IV, Marfan's Syndrome, neurofibromatosis Type 1 and autosomal dominant polycystic kidney disease. Acquired factors include age, gender, alcohol use, smoking, traumatic brain injury, sepsis, hypertension, atherosclerosis and seasonal variations. From this I concluded that environmental triggers do not exist. However, there may be a common feature within the factors I found.

PRE AND POST-GLOBALIZATION IMPLICATIONS ON THE INTERNATIONAL CURRENCY MARKET

Presenter
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Advisor
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I have examined developments in Mexico, Russia, and China over the last decade to determine how currency markets have been affected by the advent of globalization. Through a case study approach, I have learned about central bank intervention, market liberalization, and the impact of opening currency markets to the individual investor. In the case of Mexico, central bank intervention is a necessary form of crisis prevention on a macroeconomic scale. In Russia and China, I learned the differences in two former Communist governments toward trading their currencies on the foreign exchange. I have also learned that liberalizing currency policy too quickly, as in Russia's case, leads to devastating economic setbacks. On the other hand, as in China's case, the government is proceeding too cautiously in opening up their markets. In an effort to counter this approach, the United States is currently placing pressure on the China to "un-peg" its currency and move to a floating currency policy. Finally, I conclude with my analysis of specific interventions on behalf of the Bank of Japan and others. I also discuss currency trading as an example of the advent of globalization in currency markets, as individual trading only began in 1995.

LOOKING GLASS OF THE MIND: IDEOLOGY AND VISUAL ARTS DURING THE RENAISSANCE AND NINETEENTH CENTURY

Presenter
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Ideology and the visual arts have a direct relationship. During the Renaissance, ideas such as humanism, civitas, and neo-Platonism influenced the subjects of Renaissance art. Humanism, the idea of celebrating the beauty of man and imitating antiquity, can be recognized by the depiction of the classical human nude such as Michelangelo's David. The Florentines performed Roman civitas, or civil service, by building the church Santa Croce for the city. Neo-Platonism emphasizes the ability of man to "touch the mind of god" by pursuing Truth. Thus, in "Primavera," Botticelli painted Greek mythological figures to illustrate allegories of the pursuit of Truth. Similarly, the nineteenth century art reflects a multiplicity of ideologies. Enlightenment rationalism emphasized the pursuit of truth through reason and ancient classical ideals, which neoclassical art reflects. Romanticism emphasizes the non-rational and creates its own art movement, which reflects nature and emotions. Marxism illustrates the struggles of ordinary people and the realistic art movement serves the purpose to inform people of the realities of life. Impressionism reacts to all the above ideologies and paints the world in a new and beautiful light.

RELATING STRESS LEVELS AT IMSA

Presenter
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Mentor
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My mentorship was established in order to try to both find and reduce the causes of the high stress levels at the Illinois Mathematics and Science Academy. Through a random pool selected from all three classes at the academy, Dr. David Evenson and I hoped to use a survey system in order to find the causes of stress at IMSA, what about these specific things were stressful, and how the academy could be able to help students with these problems. Also, by having a wide selection of students and by taking collections throughout the year, Dr. Evenson and I hoped to find out if students were under more stress at different times over the course of the year, and if factors such as age and sex would have affects of stress.

Even though at the end of the year Dr. Evenson and I were not able to collect data for our project, we still have great hopes for our project. I hope that I will be able to pass my mentorship down to another student next year to continue our research.

MECHANISM ELUCIDATION OF NON-MITOGENIC ANTI-CD3 ANTIBODY TREATMENT IN EAE

Presenter
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Mentor
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It is widely accepted that autoreactive T cells escape the process of thymic negative selection to initiate autoimmune disease development and progression. Previous studies have investigated the therapeutic potential of numerous immunotherapy treatments to combat these autoreactive T cells, but unfortunately, protective outcomes have also been accompanied by non-specific negative side-effects. In the current study, we investigated the treatment potential of non-mitogenic versions of the CD3-IgG1 antibody to achieve a state of immune tolerance within the context of the EAE model of multiple sclerosis. Our investigations of both the CD3-F(ab')2 antibody, with a truncated Fc region and the chimeric CD3-IgG3 antibody proved to effectively inhibit clinical disease progression and antigen-specific T cell proliferation, thereby suggesting the efficacy of the treatments. Importantly, both in vivo and in vitro non-mitogenic antibody treatment failed to either induce apoptosis or deletion of antigen-specific CD4+ T cells. However, both treatments induced significant levels of intracellular Ca^{++} flux in the absence of cellular activation and proliferation, suggesting that the non-mitogenic treatments may be active signaling inhibitors. Taken together, our findings suggest that non-mitogenic antibody treatment may actively induce a state of immune tolerance and confer protection against the progression of autoimmune disease.

THE FEASIBILITY OF INTRODUCING BROWN TROUT TO BUCK CREEK

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The feasibility of introducing brown trout into Buck Creek, a stream in eastern Iowa is being considered. The parameters of similar streams where trout have been introduced were examined to gain better understanding of the collected data. Using a GPS (Global Positioning System) to designate sample points on the stream, several readings were taken from a two-mile long section. Data collected from these sites during different points in the stream's natural cycles assessed nitrates, nitrites, dissolved oxygen, ammonia, hardness, temperature, pH, phosphate, and turbidity. Data was recorded at different water levels and different temperatures, including samples taken when a layer of ice covered the stream. Using instruments and test kits, the content level of these chemicals was analyzed to determine the stream's overall chemistry and its suitability to sustain brown trout. Findings will be submitted to the Iowa Department of Conservation for approval for the introduction of brown trout. If approval is granted, trout will be released into the stream and monitored for their health and behavior in the wild. The effects of species introduction on the environment will be monitored. In addition to Buck Creek, two small ponds are also under consideration for species introduction. However rainbow trout are more likely candidates for this environment.

CAPACITY AND REUSABILITY OF SECONDARY CELLS

Presenter
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Advisor
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Using secondary cells (rechargeable) over primary cells (not rechargeable) has benefits in both economy and environmental friendliness. Firstly, this inquiry attempts to quantify the capacity of three types of secondary cells, nickel cadmium, nickel metal hydride, and rechargeable alkaline. The alkaline manganese dioxide primary cell is tested as a baseline for comparison. AAA and D size batteries constructed with these cell chemistries are tested for capacity in four common electrical devices: a CD player, a calculator, a flashlight, and a stereo. It was found that nickel metal hydride and rechargeable alkaline batteries out perform the older nickel cadmium batteries, but standard alkaline batteries remain the best in capacity. Secondly, this inquiry attempts to devise mechanisms to test the number of times a battery can be recharged. The mechanisms devised involve fairly complex electric circuits to automatically charge and discharge batteries. A computer would be used to record voltage data, which would then be analyzed manually. Though originally intended, it was not possible to actually perform such tests using the mechanisms devised due to the amount of time needed to perform reusability tests (up to many months on end).

BREACHING THE PERITROPHIC MEMBRANE OF THE DROSOPHILA LARVAE

Presenter
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Mentor
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Copper cells in the midgut of the Drosophila larva secrete stomach acid. One way to study the biology of these cells would be to feed a pharmacological agent to the larvae and study the effects on acid secretion. However, such experiments have been impossible because the ingested food is separated from the copper cells by a peritrophic membrane. The peritrophic membrane is a barrier that surrounds the food and protects epithelial cells from pathogens. However, the peritrophic membrane also prevents experimental agents from reaching the epithelial cells. Our goal is to better understand the properties of the peritrophic membrane so that we can bypass it and study the copper cells. In feeding experiments, the fluorescence dye FITC freely crossed the peritrophic membrane and into the apical domains of copper cells. FITC coupled with dextran did not. These two markers are being used to search for agents that disrupt the permeability barrier of the peritrophic membrane.

THE IMPLEMENTATION OF CLASSICAL MUSIC TECHNIQUES INTO MODERN MUSIC

Presenters
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We are writing original music by combining hard elements of punk rock, such as power chords, with techniques and instrumentals usually associated with more classical forms of music, such as violin riffs. Understanding music theory gave us a better understanding of technical chord and scale progressions, as well as knowledge about the differences of each type. This assisted with the integration of classical techniques into our music. Currently, we have two songs completed and one song as a work in progress. We plan on recording our songs and playing them during our presentation. In each of our songs, we have incorporated the aforementioned elements of rock with elements of more classical music. In our music, we use common guitar chords as well as creative violin solos. In addition, we plan to incorporate percussion into our music. Coupled with vocals, we feel that our songs are original and unique.

THERAPEUTIC EFFICACY OF ENVIRONMENTAL ENRICHMENT AFTER EARLY-LIFE SEIZURES

Presenter
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Mentor
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Children who are ailed by epilepsy often experience status epilepticus, which is an ongoing convulsion that continues for 30 minutes or more. This condition can lead to school failure, behavior problems, or even memory impairment. Although treatments exist that prevent the onset of seizures, anti-epileptic drugs for example, no treatments that promote recovery and neuron regeneration currently exist. The project proposes enriched social environments combined with visual, spatial, auditory, and tactile stimulation as treatments for status epilepticus.

This research involves inducing status epilepticus in immature rats at postnatal day 20 with kainic acid, a chemical convulsant commonly used to induce seizures. Rats are placed in either enriched or isolated environments for 7-10 days and are compared behaviorally and physiologically. Behavior tests, which include an open field test, run on all trials of the experiment show decreased exploratory behavior in isolated kainate rats while kainate rats placed in the enriched environment behaved similar to control enriched rats ($n=37$, $p<0.001$). This shows that the environment has reversed the detrimental effect of KA-induced seizures on exploratory behavior. Microarray analysis of hippocampal samples with nearly 16,000 RNA probes showed significant up-regulation of ARC, Egr1, Egr4, Stk2, and Wnt5a (genes with major roles in proliferation, maintenance of long-term potentiation or in memory consolidation) in rats placed in the enriched environment. Kainate rats placed in isolation experienced significant down-regulation of these genes.

Placing children in social environments rather than keeping them isolated after they have experienced seizures may promote recovery from status epilepticus and improvements in exploratory behavior, memory consolidation, and learning.

CCD TECHNOLOGY

Presenter
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Advisor
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Charged-coupled devices (CCDs) are used to electronically photograph the night sky. Through the CCD's greater sensitivity to light, they provide control for the astrophotographer, but have several distinct disadvantages. The goal of this inquiry was to track the period of the variable star Beta Persei with the CCD. Using a Meade 416XT CCD and Epoch 2000 software, photographs were produced of various astronomical objects and techniques were learned to focus and guide the camera. Three main problems had to be overcome. The first problem was subtracting light from the photographs that was not produced by the object being photographed. These sources of light are light pollution from surrounding lights, current produced by the camera, dark spots caused by atmospheric disturbances, and dust on the telescope lenses. Correction was accomplished by taking photographs of the problem, such as a car headlight, and then subtracting the frame from the image. The second problem was using outside sources to properly track the telescope while an exposure was being taken. The third problem was using Epoch 2000 software to bring out the features being emphasized in the picture while not making them look artificial. These experiments showed that Beta Persei has a magnitude that ranges from one to four. The established range of magnitudes for Beta Persei is 2.1 to 3.4.

FISH FARMING IN THE DEMOCRATIC REPUBLIC OF THE CONGO: WHAT GOES INTO CREATING A FISH FARM?

Presenters
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In the Democratic Republic of the Congo, 2,300 people died a day, every day, between 1999 and 2003 due to disease, malnutrition, and war. Currently, 80% of the people live in absolute poverty. The average income is only twenty-five cents per day, while the cost of living is nearly twice that of the United States. A business proposal was created to build fish farms in the Congo that will provide food and jobs. With funding and general help from the Congo North American Friendship Association (CONAFA) we have been in contact with country officials that welcome our project, and will donate land when the implementation of our plan is underway. Our farm uses earthen breeding ponds and a fish native to Africa, the tilapia, because it has genetically altered to breed only the larger males, which will create a larger crop. In order to implement this plan, we needed to figure out if the project was feasible. After finding actual prices in the Congo and working them into our business proposal, we have found the project will cost considerably less than what we originally estimated. CONAFA is currently recruiting people to travel to Congo and assist in implementation, once our plan is complete.

SUPPRESSION OF METASTASIS BY MITOGEN-ACTIVATED PROTEIN KINASE KINASE 4

Presenter
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Mentor
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The Mitogen-activated Kinase Kinase 4 Protein (MKK4) has proved to suppress metastasis in mice with prostate cancer. The marked suppression of metastasis eliminates most spreading of the tumor; however, it does not affect primary tumor growth. When activated during stress the MKK4 protein suppress metastasis by acting as the suppressor gene that is encoded by the human chromosome 17. The MKK4 signals through JNK/SAPK signaling pathway. The metastases are suppressed through the activation of the JNK pathway. The MKK4 can be activated by various extra cellular stresses. This in essence "turns on" or "turns off" MKK4's suppressing ability. The ability of MKK4 to suppress metastasis can be useful to predict if a tumor will metastasize. The activation ability is beneficial because the activity of MKK4 can be used as a target for cancer treatment

EDUCATIONPLUS.COM: INTERACTIVE EDUCATION IN MATH, SCIENCE, AND TECHNOLOGY

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Educationplus.com is a website developed over the last years that provides interactive education in math, science, and technology. The Units Converter and the Online Virtual Organic Chemistry Lab were the focus of this year's work.

To understand, use, and compare scientific and mathematical units, a consistent measurement of units is essential. This is the sixth year of a long-term project to develop a website for users to convert multiple types of units to a consistent standard of measurement. The Units Converter has the ability to return a specific number of decimal places in the answer. Within the Units Converter, multiple functions convert between discrete types of measurement. Incorporating JavaScript, this website encompasses twenty-six sets of units, including more obscure conversions such as magnetism, viscosity, and computer storage. Planetary weight and illuminance converters were both added this year.

The second part of educationplus.com is the Online Virtual Organic Chemistry Lab which allows the user to obtain results from various tests on an unknown compound to deduct what the compound is. Previous glitches pertaining to the virtual 'cost' of each test, as well as errors displaying results in the form of graphs were addressed. This year we added five more compounds to the original set: ethyl acetate, benzene, toluene, carbon tetrachloride, and methylisobutylketone.

INVESTIGATION OF POSSIBLE STRUCTURAL CHANGES OF ADDLS AT PHYSIOLOGICAL TEMPERATURE

Presenters
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Mentor
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Though experts long attributed Alzheimer's disease (AD) to the formation of fibrous amyloid plaque in the brain, recent research suggests that globular, soluble oligomers, called Aß derived diffusible ligands (ADDLs) , are responsible for the disease. Testing has shown that these oligomers act as ligands, binding to the cortex and hippocampus membrane proteins (p260 and p140). Synthetic ADDLs are able to maintain a fibril free state for several days. The focus of this investigation is testing for the possible shift in size or structure of the ADDLs incubated at physiological temperature (37°C). The ADDLs are separated via size separation chromatography, producing two distinct fractions (Peak 1 and Peak 2). Part of each fraction is stored at 4°C and the other is incubated at 37°C. The ADDL fractions are then analyzed for size changes by centrifugation through filters with different pore sizes (50 and 100 kilodalton). We found that Peak 1 didn't pass through either filter, while Peak 2 passed through the 50 kilodalton filter, but not the 100. Atomic force microscopy (AFM) was also used to detect any change in the Peaks' structures. AFM shows that incubated Peak 1 ADDLs decrease in size while incubated Peak 2 ADDLs increase in size. The results we have collected so far, however, are not enough to draw any trend. To this end , we plan on running more filtration tests and gel electrophoresis.

A MODEL FOR TEACHING C# AT THE HIGH SCHOOL LEVEL

Presenter
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Mentor
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In the past few years, managed object-oriented programming languages such as Java and C# have gained in popularity. The rise of these more intuitive languages is due largely to their capabilities for rapid application development (RAD). I taught two such classes at Batavia High School about OPP techniques and C#, which has appeared to be the most beneficial for students (thanks to its power and flexibility, combined with the students' background in C++). I introduced the students to valuable programming resources and elegant OOP techniques and assigned them projects which required demonstration of a working knowledge of C#. I was able to asses the students' progress by way of presentations for the final projects. The level of the students' progress and initiative had been unexpected. On many occasions, the students exceeded my expectations, applying their knowledge in unique and inventive ways. One such pupil had even researched the DirectX API and wrote an application with its graphical capabilities.

CATCHING DEPRESSION FROM YOUR BEST FRIEND? THE CORRELATION BETWEEN THE BORNA VIRUS AND CINICAL DEPRESSION

Presenters
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Studies have shown a correlation of infection by the Borna Disease Virus (BDV) with the development of clinical depression. Our inquiry undertook an investigation of the literature in order to understand the research and analyze the conclusions. Several studies tested patients with depression to determine whether they carry antibodies or the RNA of this virus. When compared to healthy, non-depressed controls, the results showed a significant correlation of antibody presence and depression. The standard for determining whether an infectious agent causes disease is whether Koch's postulates are met. Healthy rabbits were transfused with blood from infected patients and observed for signs of depression. The rabbits exhibited signs of depression such as sluggishness and loss of appetite. After reviewing the literature, we believe that infection with the Borna Virus increases the risk of clinical depression.

ASSOCIATION OF SCHIZOPHRENIA WITH A BALANCED TRANSLOCATION OF CHROMOSOMES 6 AND 11

Presenters
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Our main mentorship project has focused on examination for the possibility of a balanced translocation of chromosomes 6 and 11 in families with members suffering from schizophrenia. Holland and Gosden (1990) suggested a possible relationship between the translocation and psychotic illness in a three-generation English family where both were present. A few years later, Jeffries et al. (2003) molecularly defined the translocation breakpoint, thus enabling the development of an assay to examine for the presence of the translocation in schizophrenia families collected by Dr. Gejman and others over the years, most of which have British Isles ancestry and which have shown previous evidence for linkage of schizophrenia to the region of chromosome 6 where the breakpoint occurs. Therefore, we are examining DNA collected from individuals in families with schizophrenia for evidence of this balanced translocation of chromosomes 6 and 11. We are using two sets of PCR (polymerase chain reaction) primers for our tests: F6, R6, F11, and R11 (F=forward, R=reverse, and the numbers correspond to the chromosome). For example, pairing F6 and R6 should amplify a DNA segment residing on a normal chromosome 6, and pairing F6 and R11 should amplify a DNA segment residing on a translocation chromosome containing part of chromosome 6 and part of chromosome 11. Thus far, we have examined 192 DNA samples using the F6 and R11 primer, including a positive control DNA (i.e., DNA from a member with the translocation from the original family in which the translocation was discovered). After electrophoresis six samples each displayed a specific band (indicating a DNA segment of a particular size) when the PCR products were separated based on size via agarose gel electrophoresis with ethidium bromide staining of the DNA; two of these samples corresponded to the positive control DNA. Since the other samples displayed a band we hypothesize that the subjects corresponding to these samples have the translocation in their DNA. Our next steps are (1) to complete the initial screen of the collection, (2) to re-check the entire families of positive subjects from the initial screen, and (3) if replicated thusly, the next step would be sequencing to further identify and confirm the presence of the chromosomes 6 and 11 translocation breakpoint in these subjects. We are also considering examining for the presence of the translocation in a control sample, i.e., one without individuals with schizophrenia.

TOOLS FOR EVALUATION IN THE DESIGN PROCESS

Presenter
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Mentor
Mr. Charles Owen, Illinois Institute of Technology, 350 North LaSalle Street, Chicago, IL, 60610; 312-595 4909; owen@id.iit.edu

The design process demands originality and creativity while evaluating current systems, finding weaknesses in them, and designing original solutions for these weaknesses. In this process, many problems come up that professionals have been trying to solve to make the process smoother. One of these problems is evaluation. Many designers, engineers, and methodologists believe that most types of evaluation are more reliable if rational processes are used instead of intuition and guesswork.

To better understand the current field of evaluation, the first step taken was to study and list existing methods. This comprised many different types of techniques including methods meant for individuals and for groups, for evaluation of one subject and for many alternatives, and for finding single best solutions and ranked orders. Using two computer programs, RELATN and VTCON, which grouped these techniques based on their similarities, it was possible to find areas in the study of evaluation which are lacking. Based on this research, an original prototype was made for a new group evaluation technique, which was tested for performance on different groups, and that can hopefully be a valuable contribution to the design field.

RE-EXPRESSION AND DECREASED PHOSPHORYLATION OF THE MYOSIN LIGHT CHAIN ISOFORMS OCCURS WITH AGE AND HEART FAILURE

Presenter
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Mentor
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We have been studying a transgenic mouse model of Protein kinase C over-expression in the heart; which slowly progresses to heart failure over time. Simultaneously, we have noted that age matched control mice have displayed a number of interesting phenomena, which essentially represent a change in the composition of the myofilaments. Mechanical and biochemical properties of these hearts demonstrate a series of temporal events that mark the progression of disease. Events at 3 and 6-months are associated with compensatory mechanisms whereas events at 9 and 12-months demonstrate signs of failure. Myofibrillar protein composition is altered due to the re-expression of the myosin light chain atrial isoforms (MLCa) in the ventricles of both TG and control mice at 9-months. The expression of the atrial isoforms is associated with a loss of MLC-2 phosphorylation at 12-months as determined by Western blotting with a phospho-MLC antibody and 2-D electrophoresis. These data suggest that the propagation of cardiac disease in the TG model is due, in part, to changes in myofibrillar protein composition and/or phosphorylation. The re-expression of the MLC atrial isoform with age may be benign but when coupled with activation of protein kinases, the altered phosphorylation substrate appears to change the regulatory balance of the myofibrils to depress the contractile properties of the heart.

DOES LEARNING LEAD TO NEW SYNAPSE FORMATION?

POSTSYNAPTIC ANALYSIS OF MOSSY FIBER OUTGROWTH THROUGH LABELING WITH A NEURONAL TRACER

Presenter
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Mentor
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In addition to methods of presynaptically analyzing synapse growth in the hippocampus (i.e. western blotting, in situ hybridization), postsynaptic labeling with biocytin provides an additional method to analyze neuronal growth and new synapse formation (NSF). There has been evidence that mossy fibers, normally terminating on apical dendrites of pyramidal neurons in stratum lucidum of CA3, may sprout new projections into stratum oriens of CA3 on basilar dendrites after training. Also, mossy fibers in transgenic mice have been hypothesized to sprout new projections after GAP-43 overexpression. (Benowitz and Routtenberg, 1997) These methods of biocytin labeling will allow investigators to analyze synaptic growth, strictly by labeling parts of the cell. If biocytin labeling can show new neurite outgrowth after training or after overexpression of a growth-associated protein (GAP-43), additional insights into learning and memory formation can be formulated.

THE RELATIONSHIP BETWEEN PSYCHIATRIC SYMPTOMATOLOGY AND THE GENETIC CODING OF VOLUNTEER SUBJECTS

Presenter
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Mentor
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An experiment was done to find a relationship between psychiatric symptomatology and the genetic coding of 126 subjects. In a previous study, an adenosine receptor gene polymorphism was found to have an association with high anxiety after caffeine ("Association Between A2a Receptor Gene Polymorphisms and Caffeine-Induced Anxiety"). Therefore, in this study we investigated the subjects' responses on the SCL-90-R, a psychiatric rating scale. We examined subjects' level of anxiety over the past week in relation to their gender and genotypes. The SCL-90-R questionnaire was used to evaluate subjects' mood state over the recent week. Subjects were genotyped on the adenosine receptor gene polymorphism previously associated with anxiety after caffeine. Specifically, subjects with genotype T/T reported the most anxiety after caffeine. In the present study, genotype C/C was found to have the greatest anxiety state in the past week for men and women together, but women scored overall higher than men. The different conclusions may have resulted from factors such that in the previous experiment, participating subjects rarely consumed caffeine, while this study, included regular caffeine users as well as nonusers.

SURVIVAL OF A 9-OUNCE 26.9 WEEK PREEMIE: WAS IT REALLY A MIRACLE? AN EXTREME CASE OF GROWTH RETARDATION WITH NORMAL COGNITIVE DEVELOPMENT AT 14-YEARS OF AGE.

Presenters
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Mentor
Dr. Jonathan Muraskas, Loyola University Medical Center, Dept. of Neonatology, 2160 S. First Ave, Maywood, IL, 60153; 708-216-1067; 708-216-9434; jmurask@ lumc.edu

Newborns weighing less than 400 grams (13 ounces) are known to catch considerable media attention, as small sized babies tend to be a phenomenon among the public. However, what the public fails to realize is that birthweight plays a small role in the survival of a baby. The importance of gestational age, and gender in viability, realistically, play a more significant role. Madeline, a baby born at Loyola Medical Center at Chicago at 9 ounces and 26.9 weeks endured much media coverage for her extremely low birthweight. We examined a fourteen-year follow-up of Madeline and analyzed trends in her unique birthweight category. Also, we read current literature on neonates born at threshold of viability and registry data on the 52-documented newborn that weighed less than 400 grams (13 ounces). Most babies between 26 and 27 weeks, weighing 2 pounds have a 90% chance of survival. In contrast, a baby born at 23 to 24 weeks, weighing 1 pound only has a 5% chance of survival. Evidently, the chance of survival slips away with only 1 pound. At two, Madeline had normal development and when starting school matriculated normally through all grade levels. Altogether, we noted that although her birthweight was low, her gestational age of 26.9 gave her a 90% chance of survival. Thus, gestational age is what determines the viability of a newborn.

MODELING OF FREE-SPACE OPTICAL SYSTEMS IN MATLABOPTICS

Presenter
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Mentor
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Optics promises to revolutionize electronic processors and systems, making devices smaller, faster, and more efficient. Free-space optics interconnects and switches can eliminate electrical wires, and supplant current technology without changing the language it is based on. In optical systems, lasers are transmitted to convey information. Their intensity can be altered and detected so that an intensity threshold can be set. Beams detected over the threshold are assigned a value of 1 and beams under the intensity limit are assigned 0, allowing optical systems to adhere to binary code, the language current processors run on. The main problem confronting this burgeoning field is cost. Micro Opto-Electronic Mechanical Systems (or MOEMS) are fabricated at the micron level (10-6 meters): a gift and a curse. MOEMS are so small that producing error free systems are extremely difficult. The tools needed to fabricate systems are costly and designing multiple unsuccessful prototypes is prohibitively expensive. Determining an acceptable margin of error inherent in the systems to allow them to function at a satisfactory level is necessary to improve cost-efficiency. This research focuses on computer programs designed to simulate certain aspects of MOEMS to ascertain that margin.

THE GODFATHER: ENHANCING STEREOTYPES EVERYWHERE

Presenters
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Mr. Christopher Kolar, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, On-Line Learning, Aurora, IL, 60506; 630-907-5074; ckolar@imsa .edu

It has been suggested that images in the media can influence even the most freethinking of individuals. IMSA students characteristically identify themselves as free thinkers with unique experiences that have exposed them to a variety of notions on many varied topics. A study was conducted to determine whether watching a clip from "The Godfather" affected IMSA students' perception of Italian Americans. With the help of Christopher Kolar, a survey became an efficient way to determine relationships between stereotypes present in films and previous knowledge . The survey uses a six-point scale for rating the agreement level with certain statements and worked in conjunction with a computer program, which would help sort the data into a more comprehensible format for analysis. Through the process of revising the surveys, the researchers learned the proper method for creating a survey, the most beneficial questions to ask to measure change in opinion, and the logistics of giving a survey using the computerized system. Work is currently underway to show the clip and administer the pre and post viewing survey. The data will be analyzed in terms of variations among students from various ethnic backgrounds when compared to those students who identified themselves as Italian American.

THE MATHEMATICS OF MAGIC: THE GATHERING. WHAT CAN PROBABILITY TELL US?

Presenter
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Magic: The Gathering is a collectible card game that was created by mathematician Richard Garfield in 1993. It is a game of luck and strategy. As with any other card game involving luck, probability should be able to help determine how a deck will perform. My first trial involved working with a simple deck of just two kinds of cards. The two cards worked together and could win by the fourth turn. Since a player starts with a seven card hand in a sixty card deck of two different cards , I calculated the eight possible starting hands and the probability of getting each of those hands using multinomial coefficients. Then, by finding the possible paths to victory through the first four turns, I could backtrack and find the probability of winning with the deck on the fourth turn. This is a system for finding the probabilities of having a certain hand by a certain turn. Thus, this system works for any deck that can win by a certain turn given a certain combination of cards in the right order. In other words, this sytem can calculate the possibility of winning on a certain turn with any "combo" deck.

DEVELOPMENT OF A WHOLE BLOOD FLOW CYTOMETRY METHOD FOR FUNCTIONAL ASSESSMENT OF PNEUMOCOCCAL PHAGOCYTOSIS

Presenter
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Mentor
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The purpose of this project is to develop a functional whole blood assay for immune-compromised children that will assess the individual immune response by using the patient's own cells. Today's surrogate assays are not necessarily relevant to this specific population who often experience immune dysfunction. Also, this assay will also help determine the efficacy of vaccines that were used for patient immune reconstitution. This project observes both phagocytosis (engulfment of the opsonized bacterial cell) and oxidative burst (actual killing of the bacterial cell) activity in both monocytes and granulocytes through use of a flow cytometer. Because of its strong fluorescence, FITC (fluorescein-isothiocyanate) was used as the primary control dye to stain seven commonly occurring pneumococcal strains that compose the heptavalent vaccine: 4, 6B, 9V, 14, 18C, 19F, and 23F. However to simultaneously test oxidative burst, an alternative dye was needed. Currently, optimal properties of ethidium bromide monoazide (EMA) are being investigated because EMA staining is irreversible. To observe the uptake of stained bacteria in both monocytes and granulocytes, histograms using CD-33 gating were employed. In the future, this assay will be applied to patient samples and will have the ability to test the effectiveness for a variety of bacterial vaccines.

IMSA ON WHEELS: KIDS TEACHING KIDS

Presenters
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IMSA on Wheels is a student-developed mobile science program that began presenting elementary assemblies during Intersession 2003. Using survey responses from the 2003 show and research about elementary curriculum, the topic "Air and Pressure" was selected for presentation in 2004. The goal was to show elementary school students demonstrations they could not see on a regular school day. This way, they could become more excited about science. Numerous air and pressure demonstrations were tested fall semester, resulting in fifteen exciting demonstrations, such as "Mandeburg Hemispheres" and "Bed of Nails." During Intersession, twelve new student presenters received hands-on training at eight schools, to a total of 1,019 students. Throughout the week, teacher surveys were evaluated and first hand observations of student response and presenter feedback were taken into account to modify the show. Eight out of ten schools that have seen the show have returned surveys, indicating positive feedback. Based on a 4.0 scale, teachers evaluated the show to be: informative (3.6), pertinent (3.2), interesting (3.7) and fun (3.6). Letters were also received from students expressing their enjoyment of the show while demonstrating retention of science concepts presented. In 2004, IMSA on Wheels has reached over 2,200 students in fourteen schools throughout Illinois, including a spring break tour through central Illinois.

GOT FASHION? DOES YOUR STYLE AFFECT HOW YOU ARE HELPED?

Presenters
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Many studies have been conducted to show that attractive people are treated better than unattractive people. In correlation with these types of studies, we questioned if this concept held true in concordance with people's attire. To test this, we observed the willingness of people to help two males and two females, each dressing in appealing and non-appealing clothing. Appealing clothing was considered to be a nice shirt and pants and the unappealing outfit was a hooded sweatshirt and baggy pants. Each person dropped a folder with several pieces of paper and we counted how many people helped them, of the people that passed by. To determine if people believe that they do not care about people's attire when they really do, we asked the people that passed up our confederates what they thought was more important, a person's attire or personality. Data are being analyzed to determine whether individuals are more willing to assist people dressed in nice attire.

EFFICIENCY STUDY OF ROCKET NOZZLE SHAPES

Presenter
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Advisor
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The purpose of this study has been to determine the relationship between the amount of thrust produced by a rocket engine as affected by the shape of the exhaust nozzle. The nozzle is the component of a rocket engine that generates thrust by converting thermal energy from hot chamber gases into kinetic energy and directing that energy along the nozzle's axis. The main purpose of the nozzle is to expand the gases as efficiently as possible to maximize the exit velocity. The most important factor in rocket nozzle design is therefore, the expansion area ratio, that is, the ratio of the exit area to the throat area. I have focused on two popular nozzle shapes, parabolic (bell) and conical. The difference between these two shapes is the divergence angle. Through the use of a force transducer and computer software, I plan to obtain thrust data to analyze the efficiency of each nozzle shape. Preliminary testing at 10 psi propane has shown that the thrust from the parabolic nozzle is so great that a sustainable amount of pressure is exceeded and safety measures were activated. Further testing is underway at lesser propane pressure and a lesser ratio of oxygen gas to propane.

THE EFFECT OF SYSTEM PARAMETERS ON THE PRE-TRANSITION SWELLING OF CHARGED HYDROGELS

Presenters
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Mentors
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Dr. Anthony Lowman, Drexel University, College of Engineering, 3141 Chestnut Street, Philadelphia, PA, 19104; 215-865-2228; alowman@drexel.edu

We investigate the effects of pH, sub-chain length and suspension salt concentration on the pre-transition swelling of charged poly methacrylic acid (PMAA) hydrogels. We see that if no salt is added to the solution, the degree of swelling is set by the balance between the sub-chain stretching and the degree of charge dissociation. As a result, gels composed of longer subchains are significantly more swollen than their short-chain counterparts. However, when salt is added this trend may reverse, so that short sub-chain hydrogels are more swollen than the long-chain ones. This is due to the fact that salt plays a dual role: Increasing the charge degree of dissociation, but decreasing the range of electrostatic interactions

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RANDOM NOISE AND PURPOSEFUL SENSATION: THE RELATIONSHIP THAT WILL IMPROVE POST-STROKE REHABILITATION

Presenters
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Mentor
Dr. David A. Brown, Northwestern University Feinberg School of Medicine, Dept. of Physical Therapy and Human Movement Sciences, 645 N. Michigan Ave Suite 1100, Chicago, IL, 60611; 312-908-0976; dbrown1@northwestern.edu

Neural damage from stroke affects senses including proprioception, the sense of the position of body parts in space. Many individuals post-stroke have difficulty performing tasks such as walking, which is partly caused by poor processing of sensory input. Stochastic resonance (SR) is a new stimulation technique, affecting the firing of muscle spindles, which has been shown to improve sensation threshold but not limb position sense in separate studies. This effect may also affect movement detection threshold and LPS, which allowed for a one-tailed experiment comparing stimulation levels of 0.0 and 0.005. Using a pedal ergometer and muscle stimulators, we tested the effect of stimulation levels on healthy control subjects' movement detection threshold and limb position sense error (LPSE). We hypothesized that background noise from SR will improve threshold detection and a low level (.005) of SR will sharpen LPS. Overall, we tested the idea that muscle stimulation from background noise, applied at the appropriate levels, would have beneficial effects on movement detection and limb position sense. Ultimately, this technology, if proven beneficial, may revolutionize post-stroke rehabilitation by offering a method for improving sensory input during relearning of complex motor tasks such as walking.

EXFOLIATION OF CLAY NANOPARTICLES THROUGH POLYMERIZATION

Presenter
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Mentor
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By cationically polymerizing a mixture of epoxy and Cloisite, a natural montmorillonite, the layers of Cloisite will be intercalated. It is possible and desirable that these Cloisite layers will be exfoliated by the replacement of active centers embedded between Cloisite layers with monomer molecules, which grow into polymer chains when the solution is reacted. Samples were mechanically mixed for five minutes and heated overnight at 80°C. Once polymerized, plaques were postcured to ensure that all active material had been cured. To judge the properties of the samples, many tests were performed. Using a Dynamic Mechanical Analyzer (DMA), the loss and storage moduluses of the composites were assessed. This allowed for a calculation of the transition temperature from a glassy state to a rubbery one (the TG) as well as the storage modulus at 75°C after the TG, approximately the area where the storage modulus levels out after the peak(s). Using Fourier Transform Infrared (FTIR) spectroscopy data, a graph was also composed of the ratio between the size of the epoxy peak (which decreases as polymerization occurs) and a peak that is constant for all samples. This ratio is a measure of how well reacted the samples are.

AIR POLLUTION, REDUCTION AND ITS EFFECTS

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Ozone is both good and bad for you, depending on its location in the atmosphere. In the stratosphere, or upper region, ozone works to protect life. Twenty years ago, a hole in the stratospheric ozone layer was discovered and the world became aware of pollution as problems steadily appeared. Dr. Mario Molina showed that chlorofluorocarbons (CFCs), manmade chemicals, progressively increased ozone destruction. For this discovery, Molina shared the Nobel Prize in 1995. More recently, he has been involved with the Mexico City Case Study to find methods of reducing air pollution such as fog, smog, and acid rain. In this situation, there is an abundance of ozone in the lower region of the atmosphere, called the troposphere. Excess tropospheric ozone thrives in urban cities like Mexico City due to the abundance of industry, and contributes to pollution conditions. Too much tropospheric ozone results in pollutants such as nitrogen dioxide particles that burn the lungs, and sulfur oxides , which cause eye cataracts and damage to plants and animals. Through research and an interview with Molina, a biography is nearing completion, which educates others about air pollution and reduction, as well as informing about his personal inspiration.

GROWTH RATES OF CARBIDE DERIVED CARBON ON Ti_3SiC_2

Presenter
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When a carbide like SiC is exposed to a halogen like Cl_2 at high temperatures, SiCl4 results with the carbon left behind, since $SiCl_4$ is more stable than SiC. The carbon product that is left that forms on the surface of the carbide is known as carbide derived carbon (CDC). The structure of CDC is related to the structure of the carbide that it formed from and is different from either graphite or diamond. Some research has been done on CDC on SiC, but not as much as on TiC or a new titanium silicon carbide, Ti_3SiC_2. I am measuring the growth rates for CDC on Ti_3SiC_2 in comparison to SiC and TiC. This study concentrates on the growth rates of titanium silicon carbide when treated in certain high temperatures and for different periods of time. If the titanium silicon carbide proves to have a faster growth rate than the others and still retains a reasonable coefficient of frictio, hardness, and other beneficial properties, it could have more useful applications and be more suitable for mass production than the other carbides.

SEARCHING FOR R TYPE CURRENTS

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Mentor
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The aim of our group is to examine cellular mechanisms contributing to rhythmic respiratory activity. Calcium currents generally increase neuronal excitability. T-type calcium currents have been described in respiratory neurons and may aid pacemaker activity since they activate below action potential threshold. R-type calcium currents would not generate rhythmic activity, but otherwise have very similar characteristics to T-type currents. Confusion of R-type with T-type currents would lead to the wrong conclusions as to the mechanisms underlying rhythmic respiratory activity. We have detected a previously unreported R-type current in respiratory neurons. Surprisingly, over the first 4 postnatal weeks, T-type current appears to decrease while R-type current appears to increase, indicating that the mechanisms underlying breathing change during development.

THE COMPONENTS OF POSITIVE INTERACTIONS BETWEEN CHILDREN AND PLAY PARTNERS AT THE HAMILL FAMILY PLAY ZOO

Presenter
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Mentor
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The purpose of this study was to determine the components of positive interactions between children and the staff at the Hamill Family Play Zoo. The play zoo is an activity center at Brookfield Zoo in Brookfield, IL. The goal of the play zoo is to help young children develop a caring relationship with nature through activities meant to stimulate their interest in nature and their imaginations. The staff facilitate these activities, and provide interactions that are intended to improve the children's experiences at the play zoo. In order to determine what factors make those interactions significant, methods of qualitative analysis such as interviewing and videotaping were used. Children were videotaped playing in each of 5 settings, including the Greenhouse, Zoo at Home, the Workshop, Zooscape Mountain, and weekly Tot Classes. Parents were then asked to answer a series of questions regarding the interactions that they just observed between the staff and their children . They gave feedback on what they liked about the activities and the staff's roles in their child's experience. Comments represented varied thoughts such as an appreciation for the enthusiasm in the staff and for the stimulation of creative thought in the children through the offered activities.

PROJECT READ

Presenter
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Project READ addressed reading deficiencies among students challenged by factors such as high poverty and low parental involvement. Books were read and discussed, and IMSA students implemented activities to improve the students' literacy skills in four basic areas: reading comprehension, fluency, vocabulary, and writing. Project READ, coupled with classroom teaching, aimed to increase student interest in reading and standardized test scores. Some of the activities included: reading printout books, journal writing, word puzzles, and word games. Each group completed activities with an IMSA tutor that gave the students practice in the four basic areas. The activities were based on research done to find methods proven to be effective for increasing student interest in reading and literacy skills. Each visit, the students were divided into five groups based on their reading level. The students were tested at the beginning of the program and will be tested at the end to see if their reading level improved, remained the same, or decreased. A survey will be given to the participants at the end of the year to evaluate the success or failure of the program, including gauging students interest in journal writing, reading comprehension, working in small groups, and word puzzles.

THE INFLUENCE OF A NEUROPEPTIDE Y Y5 RECEPTOR ANTAGONIST ON PHOTIC AND NON-PHOTIC INPUT TO THE MAMMALIAN CIRCADIAN PACEMAKER

Presenter
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Mentor
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All organisms have biological clocks that respond to periodic changes in the environment. Circadian rhythms, periodic biological cycles of approximately 24-hours, are known to be influenced by a neuropeptide (NPY) through the Y5 receptor. We examined whether an antagonist to the Y5 receptor would alter responses to photic and non-photic stimuli. The circadian rhythm of wheel-running behavior in male Syrian hamsters treated with the antagonist of the Y5 receptor or a placebo was examined under three conditions: a light pulse given in constant darkness, an activity inducing drug (triazolam) given in constant darkness, and a dark pulse (an activity-inducing stimulus) given in constant light. The first condition tests whether NPY acting through the Y5 receptor inhibits phase shifts in response to light, the second condition tests whether NPY acting through the Y5 receptor causes phase shifts in response to an activity-inducing stimulus, and the third condition tests whether dark pulses given in constant light cause phase shifts by the same mechanism as the pharmacological stimulus given in constant darkness. This research will give us a better understanding of the role of NPY and the Y5 receptor in the entrainment of the circadian clock.

BRAIN DEATH AND ITS PERCEPTION IN SOCIETY

Presenters
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Mentor
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There is a highly diverse comprehension about the implications of devastating brain injuries. An extreme form of brain damage can lead to the irreversible cessation of all brain functions, known as brain death. However, to some people, medical and lay, the line between brain death and devastating brain injury is ambiguous. Even when there is a general agreement in what brain death is about, the methodology to make the diagnosis is unfortunately varies from hospital to hospital. Perception of what constitutes death is critical in defining the significance and approaching the diagnosis of brain death. Because the phenomenon of irreversible cessation of brain function and the definition of brain death is relatively young (< 40 years), general societal perceptions of death have most likely changed recently in meaningful ways. In this study we explore people's perceptions about the significance and current knowledge regarding brain death by surveying different demographic groups , stage an intervention to help people better understand the advent of brain death, and create guidelines to help further the unification of hospital policies regarding brain death. With enough information about the medical as well as public perspective, we can help influence the creation of a new standard, while educating the public about this issue.

ARTIFICIAL INTELLIGENCE AND ROBOTICS: SEARCH-BASED ALGORITHMS

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Mentor
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Though in its preliminary stages, our research examines the implementation of search-based algorithms into artificial intelligent robotic devices in the creation of a robot that can reliably interact with its environment. In other words, the goal of the project is to create a robot that is capable of intelligent motion and direction. Using Python, an object-oriented programming language, we have begun the coding of various heuristic search-based algorithms prototypes.

In addition, orientation to the iRobot Magellan Pro Mobile Robot has begun with simple introductions to basic commands as well as capabilities. Currently, the Magellan is manually controlled and carries 16 sonars, IR sensors and tactile bump switches, as well as a laser proximity scanner . By the completion of the project we hope to implement technology that allows for independent and interactive communication with users in the environment.

Much remains to the completion of the project, including: upgrade of Linux kernel, porting of algorithms to C++, as well as implementation of a video device. When these technologies are implemented, data will collected in an attempt to determine functionality and efficiency of modifying the robot's navigational programming.

ANALYSIS OF X-RAY DIFFRACTION PATTERNS

Presenter
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Mentor
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Alloys are materials comprised of more than one single metallic element and usually provide better physical or mechanical properties than pure elements. When an alloy is made, it usually forms a crystalline structure. One interesting phenomenon of these crystals is that when an x-ray is emitted to the crystal, it will reflect different intensities of the x-ray, depending on the atomic properties and angle between the crystal lattice and the x-ray. The intensity of the reflected x-ray not only depends on the incident x-ray beam angle, but also the composition of the crystal itself. In addition, the reflections can be plotted on a graph which shows the intensity of the reflected x-ray as well as corresponding angle between x-ray beam and lattice plane. My research compared the calculated x-ray diffraction patterns to experimental x-ray diffraction patterns quantitatively. Space groups and atom coordinates were inputted into computer software to generate x-ray diffraction patterns. After this, the experimental results such as peak positions and peak intensities were also obtained from preliminary patterns. I compiled the data into a spreadsheet and generated tables in order to present the information in a way that makes comparison between the experimental and simulated intensities possible.

THE SOCIAL AND ECONOMIC IMPLICATIONS OF THE US TRADE EMBARGO AGAINST CUBA.

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The effectiveness of the U.S. trade embargo against Cuba has been continuously questioned. In Cuba, eleven million men, women, and children endure the hardships of Marxism through Fidel Castro. This is contrasted with America's response and attempt to employ a policy to increase security, protect the Cuban citizens from the harsh realities of Castro, and spread the message of democracy. Its goal is to apply economic pressure to the country. However, instead of ridding Cuba of Castro, it has strengthened his power. Castro is able to reinforce his power and blame the social difficulties on U.S. foreign policy. The embargo also challenges freedom of trade, the movement of capital, and other policies that the United States asserts elsewhere. It is estimated that the Cuban economy has lost over $70 billion dollars mainly due to its inability to profit from tourism, foreign direct investments, and currency transfers. Despite these obstacles, the Cuban economy is beginning to look up. The government has shifted its rigid communist roots to one that is more market driven. America is losing money while acting as a spectator in this aspect of the global economy. For example, U.S. farmers lose approximately $1 billion per year in potential revenue due to the sanctions. The embargo is hurting American businessmen as much as it is effecting the common Cuban citizen.

AN EPIDEMIOLOGICAL STUDY OF MITRAL VALVE PROLAPSE IN AURORA, ILLINOIS

Presenter
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Mentor
Dr. Vijay Shah, Provena Mercy Medical Center, 1300 N Highland, Aurora, IL , 60506; 630-896-0659

Mitral Valve Prolapse (MVP) is a cardiac disorder in which the heart's mitral valve, which separates the left upper chamber (atrium) from the left lower chamber (ventricle), billows out and does not close properly. In most cases, MVP is relatively harmless while, it may induce various complications including severe regurgitation of blood. Through retrospective analysis, this study investigated the prevalence and characterization of MVP among the cardiac patients in Aurora, Illinois in a statistical manner. Primary, demographic data was collected from Doppler, M-mode, and 2-D echocardiography results at Aurora area hospitals. The control group consisted of 934 patients, who had echocardiograms taken during September 2003 – January 2004. The Framingham Heart Study was used to baseline and compare the results from this study as well. In Provena Mercy Hospital, 9 patients out of 516 (1 .74%) were diagnosed with MVP while at Rush Copley, 22 out of 418 (5.2%) – with a combined total of 31 out of 934 patients (3.3%) diagnosed with MVP in the Aurora, Illinois area. This percentage was compared to the Framingham Heart Study. The study further indicated that incidence of MVP within the population of Aurora was comparable in magnitude with similar studies, evidenced that other cardiac problems had little correlation or proclivity to MVP, and characterized dominant symptoms observed on people with and without MVP.

THE CHICAGO MERCANTILE LIGHT ARTILLERY BATTERY: UNKNOWN HEROES OF THE CIVIL WAR

Presenter
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The Chicago Mercantile Light Artillery Battery, though obscure, was one of the most distinguished units in the Union army, with six of its original one hundred and fifty-six men receiving Congressional Medals of Honor. This battery consisted of no draftees--it was a volunteer regiment. What motivated these men to enlist and how did the battery cope with the increased range of infantrymen due to the rifle, which was developed in the 1850s? Volunteers were simply treated and looked upon better once in the army than were draftees. In addition, the Secretary of War gave bonuses to soldiers upon enlistment, which, while modest at first, would still be of help to families while the men were off fighting. Many felt that they would be drafted anyway; volunteering would at least leave the family better off. The new artillery doctrine called for long-range cannon to form a line away from the action and fire upon the enemy, but these Chicagoans had a taste for close combat, and would prove it during their service from 1862-1865. The battery's greatest contribution was its role in Grant's second Vicksburg campaign, which put the Mississippi River back into Union hands, thus cutting the Confederacy in two.

COMPOST: THE OTHER RECYCLABLE

Presenter
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Advisor
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Everyday the Illinois Mathematics and Science Academy disposes of its waste, several gallons of which are comprised of decomposable organic matter. Currently paper, aluminum, glass, and plastic products are recycled on campus, but organic waste is shipped out to a landfill along with IMSA's non-recyclable garbage. The goal of this inquiry was to create a compost system reflective of IMSA's needs. On average, Arbor alone produces 15.4 gallons of compostable waste each week. It was decided that a wooden-framed compost bin would offer optimum design for our system. Located behind the Grainger Center, the bin includes a wooden divider, which separates two areas housing different stages of decomposition and allows easy turning and adequate aeration. Once the system is operating effectively, the amount of solid waste reduction, economic benefit to IMSA, and impact on the quantity of fertilization products will be determined.

DETECTION OF THE FREQUENCY OF BACILLUS THURINGIENSIS GENES IN CORN PRODUCTS

Presenter
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In 1996 genetically modified corn containing *Bacillus thuringiensis* (Bt) genes was released to the market in the United States. The Bt genes were inserted with the CaMV35S promoter which caused the corn to produce a natural insecticide to kill target lepidopteron species such as the European corn borer. This crop has created much controversy and the detection has become important over the past decade. The use of polymerase chain reaction to detect the CaMV35S promoter was validated, which indicated the presence of Bt genes in corn using DNA from Bt corn grown locally. I am currently isolating DNA to test for the presence of the CaMV35S promoter in corn chips. Toward this end, the DNA isolation procedure was modified to isolate DNA from corn chips. The amount of starting material and protein precipitate was crucial for success. Experiments are now underway to determine whether corn chips have been have been made from genetically altered corn.

THE EFFECTS OF ESTROGEN ON P53 AND ß-CATENIN IN MOUSE OSTEOBLASTS

Presenter
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Mentor
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P53 is a tumor suppressor gene that is inactive in over half of all cancers. (Vousden, 2002) ß-catenin is a cellular adhesion protein, regulated by p53. When p53 is not active, unchecked beta catenin can induce proliferation and eventually cancer (Damalas, 2001). Up until now, the link between beta catenin and p53 has been examined in only the context of cancer. Estrogen is a well-known bone protector and it has been shown to induce bone differentiation (Science, 2003). However, recent studies have indicated that p53 may also induce differentiation (Chandar, 2002).

This study examined the effects of a synthetic form of estrogen, E2, on p53 and beta catenin within mouse osteoblast cells in a normal physiological context. We used immunofluorescence to determine the subcellular localization of both the gene and the protein. Western-blotting was used to quantify the phospho-p53 and beta catenin in our samples.

The link between p53 and beta catenin was confirmed. Also, a new relationship between estrogen treatment, p53, and beta catenin was shown, namely that there is a direct correlation between beta catenin and p53 with respect to both quantitative expression and subcellular localization after estrogen treatment. This link between beta catenin and p53 may be important in normal bone differentiation.

NON-RANDOM TRADING IN FINANCIAL MARKETS

Presenter
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Mentor
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About 80% of professional traders, and 85% of amateurs lose money over time in financial markets. Over the past decade, there have been many advances in data services and tools, and information is now available to a wider audience. However, the rate of success has not changed as a result of recent technological advances. Part of the reason behind this is because traders are still making decisions based on price differentiation. In order for successful trading, one must be able to find direction, as floor traders used to do when most of the volume was still in the pits. It is critical for traders to make decisions based non-random factors such as inventory imbalances rather than random price movements.

MINIMALLY INVASIVE NUCLEUS REPLACEMENT OF THE INTERVERTEBRAL DISC: THE EFFECT OF PROCESSING ON HYDROGEL MATERIAL PROPERTIES

Presenter
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Mentor
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Chronic lower back pain plays a critical role in the lives of millions. Generally, lower back pain is coupled with degenerative disc disease, where the mechanical functionality of the intervertebral disc reduces due to dehydration of the nucleus pulposus. This prevents the disc from transmitting loads normally between vertebrae leading to herniated, or ruptured discs. If the initial dehydration of the degenerated nucleus can be detained and a fully hydrated state returned to the disc, then the degenerative process would be postponed or prevented. We propose that replacement of the degenerated nucleus with a hydrogel implant will restore the functional biomechanics to the spine segment. Further, we propose to implant the hydrogel in a minimally invasive fashion. Toward that end, this work focused on the diffusion kinetics of the hydrogel during dehydration and rehydration. We utilized mass and volume measurements to track changes to the polymer for various dehydration conditions. The results showed a non-linear diffusion mechanism which resulted from a skin coat on the surface. Visual examination of the gels was undertaken using ESEM. From the results, it has been shown that dehydration of the gels may provide a likely approach toward minimally invasive nucleus replacement.

EFFECT OF BOSWELLIC ACIDS IN INDUCING CELL DEATH IN BREAST CANCER CELL LINE MCF-7

Presenters
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Boswellia is an herbal remedy for various ailments that has been used in India for centuries. Also known as Frankincense, it is the sticky resin of the Boswellia serrata tree that helps manage respiratory and liver disorders. In modern medicine it has been utilized because of its anti-inflammatory properties to treat arthritis and bronchial cancer. Recently, studies have shown that boswellic acids also have the ability to induce apoptosis, or cell death, in colon and liver cancer cell lines. Because chemotherapeutic remedies tend to harm normal cells as well as cancerous cells, a natural treatment, such as boswellic acid, may have better selective toxicity. In this study we investigated the effects of Boswellin®, a mixture of various boswellic acids, on breast cancer cell line MCF-7 in a dose-dependant and time-dependent manner. Our initial results show that increased concentrations of boswellic acids reduce cell viability. Experiments are being analyzed to determine an LD-50 for boswellic acids. This suggests a link between the concentration of boswellic acids and apoptosis. In continuing our research, we intend to further understand the effects of the boswellic acids in inducing cell death through apoptosis assays.

THE SURVIVAL OF DREISSENA POLYMORPHA IN LABORATORY SETTINGS

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Zebra mussels (D. polymorpha) are considered an invasive species and are destroying aquatic environments throughout the United States by reducing the food supply for other aquatic organisms. The only known and practiced methods of killing the mussels are to use harmful oxidizing chemicals in enclosed habitats. The purpose of culturing zebra mussels was to find an environmentally friendly way to kill them. My research determined the essential conditions for the survival of D. polymorpha. Necessary water conditions include calcium concentrations of 28 – 109 mg / L, salinity of 5 parts per thousand at the maximum, oxygen concentrations of 70% to 90%, a pH of 7.2 – 8.7, and temperature between 0 – 30° C. Also, planktonic algae were found as the optimum food source. A permit was obtained from the Illinois Department of Natural Resources, and a tank was set up with a filtration system and algae. Because of the ice covering Illinois lakes , retrieval of specimens has been delayed, but research is proceeding, and optimal growth conditions will be discussed.

IN AND OUT OF THE HOT ZONE: A STUDY OF HEAT WAVE MORTALITY DISPLACEMENT

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Background: Despite the improvement of living conditions in the U.S., heat waves still kill in large numbers. Because many of the victims were either elderly, belonged to low socioeconomic status, and had pronounced pre-existing medical conditions, it was hypothesized that these people would have died shortly afterwards even without a heat wave. Their accelerated deaths during the heat wave therefore would produce a period of decreased mortality following the heat wave known as mortality displacement. This study investigated whether or not there was mortality displacement associated with the 1995 Chicago heat wave.

Methods: Daily mortality numbers for Chicago during 1995 were compared with a baseline mortality constructed through averaging same day mortality in 1994 and 1996. Net mortality changes were compared to estimate displacement at various time intervals.

Results: Mortality displacement was not found 3 months after the heat wave. After 5 months, however, there was 10.7 percent displacement (95 percent confidence interval, 95% CI: 6.7, 14.9). The magnitude of displacement increased to 50 percent 11 months after the heat wave (95% CI: 34.8, 75.4). The difference between the actual and baseline mortality also indicated that people over age 65 or those with cardiovascular diseases were indeed more likely to die in the presence of the heat wave.

Conclusions: Of all excess deaths observed during the 1995 Chicago heat wave, about 10 percent would have occurred within 5 months even without the heat wave. And in less than a year, about 50 percent of the heat victims would have expired anyways.

BACTERIAL PROTEINS AZURIN AND CYTOCHROME F, TUMOR SUPPRESSOR PROTEIN P53, AND THE INDUCTION OF APOPTOSIS IN HUMAN CANCER CELLS

Presenter
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The use of live bacteria in the treatment of cancer has an interesting history. The first known use of bacteria for tumor suppression, and probably the most cited case goes back to 1898, when Dr. William Coley reported that various forms of tumors regressed when infected with bacterial pathogens. It is known that the bacterial redox protein azurin is cytotoxic towards human cancer cells. Azurin is a copper based protein. Dr. Yamada and I found that cytochrome f, another bacterial redox protein, which is iron-based, is also cytotoxic to cancer cells. Here we report the effects of the presence of cancer suppressor protein p53 upon azurin, and cytochrome f cytotoxicity. We found that the cytotoxicity of azurin is dependant upon the tumor suppressor protein p53, which induces apoptosis in human cancer cells as it forms complexes with azurin. On the other hand, we determined that the cytotoxicity of cytochrome f is independent of p53. This discovery poses new questions as to why and how two very different proteins affect tumors in similar ways. It would also be interesting to see the effect of cytochrome f on cancerous tumors in vivo. Dr. Yamada and I will continue to pursue this subject in the future and try to provide answers to the questions generated by this discovery. This discovery has great significance as cytochrome f could potentially be used in the treatment of cancers that have a mutant form of p53, such as the cancers of the breast, cervix, colon, lung, liver, prostate, bladder, and skin.

THE WOODSTOCK NATION: THE DAWNING AND FALLING OF THE AGE OF AQUARIUS

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In the late 1960's, three great music festivals arose. At Monterey, an apparent new nation was born. At Woodstock, this nation reached its zenith. A utopian society, created on the foundations of peace, love, and music thought it had found the solution to the world's problems. Unfortunately, at Altamont, the Woodstock nation came to a crashing end. The hippies believed they had created a new society without race and class. But the success was completely circumstantial. By looking at the concerts, one can see that the harder it was for anyone other than middle class kids to attend, the more successful it was. This means the events that are further away from large cities will have a tendency to go more smoothly than those in the middle of a large city. Rural surroundings tend to also be more serene. This, in turn, can influence how someone will react in a certain situation. The nicer the weather and the more serene the surroundings, the more likely someone will react positively to any given issue. The inverse of this also tends to be true. These factors, along with others, all played a role in the success of the concerts.

IDENTIFICATION OF NOVEL THERAPEUTIC TARGETS IN HUMAN MENINGIOMAS

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Meningiomas (MN), highly vascular tumors formed in the meninges, account for 20% to 30% of all brain tumors. There are four common subtypes of MN, ranging from the more benign transitional, meningiothelial, and fibroblastic tumors, to the most malignant, anaplastic MN. Transitional, meningiothelial, and fibroblastic tumors do not burrow into the dura of the brain, which allows them to be removed more easily. Anaplastic tumors are extremely invasive to the brain and are difficult to remove surgically. Clearly, new therapeutic strategies are needed. Altered patterns of cell-surface glycosylation have been linked to cancer cell metastasis and invasivity. Therefore, altered glyco-gene expression in MN was studied in order to understand the mechanism for this differential tumor malignancy. Gene microarrays can be used to measure and identify a large number of differentially expressed mRNAs simultaneously. RNA was isolated from tumor tissue and electrophoresed to check for degradation. RNA was amplified, fluorescently labeled and hybridized on custom-made glyco microarrays to measure the expression of cloned glyco-genes. Detailed analysis revealed changes in expression of several genes in the different tumor subtypes. The results from the analyses will be presented. These differentially expressed genes can be used as potential targets to develop novel therapeutic strategies.

THE DISTINCT APPEARANCE OF NEUROFIBRILLARY TANGLES IN AMYOTROPHIC LATERAL SCLEROSIS

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Neurofibrillary tangles (NFTs) are characteristic of Alzheimer disease (AD) and amyotrophic lateral sclerosis/Parkinsonism-dementia complex of Guam (ALS/PDC), but are not typical of sporadic or familial ALS. NFTs were first observed in motor or frontal cortex of five Northwestern ALS patients of relatively young age (late 30s to mid 40s) but were absent from motor and frontal cortex in 5 non-neurologically impaired controls. In the ALS cases, NFTs were virtually absent from entorhinal cortex and hippocampus, unlike in AD where tangles appear first in these regions and only later in cortex. The distribution of NFTs in the ALS cases in cortex was also unlike that of AD. In AD, NFTs are found diffusely in cortical layers three and five while in ALS they were located in clusters with no relation to neuronal layers. In some cases, NFT clusters appear to be related to cortical arterioles. The significance of this observation is unclear. Screening of the remainder of the 65 ALS cases in our files is underway. With completion of this project, we hope to a better understanding of the pathophysiology of ALS.

HOW TUMOR CELLS ESCAPE THE IMMUNE RESPONSE

Presenter
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Mentors
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Neurofibromatosis is a disease in which glial cells in the peripheral nervous system divide abnormally and form tumors. The tumors grow on peripheral nerves that are often in constricted spaces, such as the head and neck. The consequences of rapid tumor growth in these areas are often fatal. Our hypothesis is that these tumor cells express a molecule on their surface that inactivates the immune system and allows them to escape immune surveillance. This molecule, called Fas ligand, interacts with an appropriate receptor on immune cells and begins a program of "cell death" effectively neutralizing the immune response. Our laboratory has several lines of these tumor-forming glial cells, which are grown in vitro. In these cultured cells, we investigated the expression of Fas ligand at the level of mRNA protein expression and its functional capacity to inactivate immune cells.

OUTSIDE THE CIRCLE: THE SECOND STAGE OF WRITING A BOOK

Presenter
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This project stems from last year's inquiry in which I wrote the first draft of a memoir centered on growing up with the label "gifted." My focus this year was revision, editing, and publication. While revision is considered a stage of the writing process, it is a whole process in itself, often requiring more time and effort than the original writing stage. My writing style has improved greatly because of revising; the narratives are stronger, the pace is quicker, and the images are more detailed. I solicited feedback from younger readers as well as my advisor and experienced writers. Their feedback helped me keep my narratives focused, and my details vivid. The book underwent a metamorphosis, expanding from the highly personal to the more universally understandable. Now, two chapters have been added to the original fourteen, and thirty more pages were added, totaling over one hundred pages. A second, very important aspect of this inquiry has been the quest for publication of selections online and in print magazines. Many chapters have been sent out already, and more will follow. With time and a few more revisions, a finished book should be coming soon.

IDENTIFICATION OF GLYCOPROTEIN B (GB) DOMAINS ESSENTIAL FOR EPSTEIN-BARR VIRUS ENTRY

Presenter
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Epstein-Barr Virus (EBV) is a gamma herpes virus that causes infectious mononucleosis and is associated with neoplastic growth, namely Hodgkin's disease, Burkitt's lymphoma, nasopharyngeal carcinoma, and gastric carcinoma. EBV can infect and undergo lytic replication in B cells and epithelial cells. Latent infection by the virus is typically asymptomatic and is established in B cells. Upon viral binding to the cellular membrane, the two membranes fuse, facilitating viral entry into the host cell. Glycoprotein B (gB) is a virally encoded protein that is essential for binding and fusion of the virion envelope with the cellular plasma membrane. To further understand the protein and locate important functional domains, we used a linker-scanning mutagenesis to insert a 15 basepair (five amino acid) segment into the gene. To pinpoint the location of the mutation we used restriction endonuclease digestion and DNA sequencing. The mutations are currently being tested in an in vivo fusion assay to map important functional domains and to investigate associations with other virally encoded glycoproteins.

THE EFFECT OF PHOSPHORYLATION AT SER422 ON TAU FILAMENT FORMATION

Presenter
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Mentor
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One of the pathological hallmarks of Alzheimer's Disease (AD) is the neurofibrillary tangle (NFT). The number of NFTs closely correlate to the duration and severity of dementia. Tangles consist of abnormal deposits of the microtubule-associated protein tau in the form of intracellular filaments. The tau in these filaments is abnormally phosphorylated. In this study we examine the relationship of tau phosphorylation to tangle formation. Specifically, we examine the effect of phosphorylation at Ser422 on filament formation. Filament formation was assessed through laser light scatter analysis and we confirmed the results with electron microscopy. We have analyzed tau filament formation using a pseudophosphorylated tau construct (S422E) compared to wild type tau (htau40) and a control mutant form of tau (S422A). We analyzed the rate and extent of fibril formation and found that the S422E polymerized slower and to a lesser extent than either htau40 or S422A. The filaments of S422E were also shorter and fewer than the other two constructs. Interestingly, the control mutant displayed more fibrils that tended to be longer than the fibrils formed by htau40. We conclude that tau S422E polymerizes the least. This may mean that phosphorylation at Ser422 can inhibit fibril formation and therefore may help prevent tangle formation in AD.

LIGHT CURVES OF BLAZARS 0509+056 AND MRK 421

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Blazars are a type of active galactic nuclei. At short wavelengths (high energy) the brightness of blazars is known to vary on short timescales. However, variance of blazars is not well studied in the visual part of the spectrum. The purpose of this research is to investigate the brightness of the blazars MRK 421 and 0509+056 and show that they vary. Observations were taken over a three-month period from the Kitt Peak 0.9-meter telescope and IDL (Interactive Data Language) was used to remove imperfections from the images and obtain the relative brightness of the blazars. Light curves were obtained for both blazars showing their variability over the three-month period

TRANSCRIPTION COACTIVATOR PBP, THE PEROXISOME PROLIFERATOR-ACTIVATED RECEPTOR (PPAR)-BINDING PROTEIN, IS REQUIRED FOR PPARα-REGULATED GENE EXPRESSION IN LIVER

Presenters
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Mentor
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Nuclear receptor coactivator PBP (peroxisome proliferator-activated receptor (PPAR)-binding protein) functions as a coactivator for PPARs and other nuclear receptors. PBP serves as an anchor for TRAP (thyroid hormone receptor-associated proteins)/mediator multisubunit cofactor transcription complex. Disruption of PBP/TRAP220 gene results in embryonic lethality around embryonic day 11.5 by affecting placental, cardiac, hepatic and bone marrow development implying that it is an essential nonredundant coactivator capable of influencing the function of many transcription factors. Since PPAR isoforms, a-, α-, and ß-, function as important regulators of lipid homeostasis in mammals, it becomes important to assess the requirement of PBP in the regulation of the functions of PPAR-isoforms in vivo. Sustained activation of PPARα by structurally diverse classes of chemicals of biological importance such as certain hypolipidaemic drugs, phthalate ester plasticizers, and herbicides, designated as peroxisome proliferators, leads to proliferation of peroxisomes in liver, induction of fatty acid oxidation enzymes and other PPARα target genes and the eventual development of liver tumors. Here we show that targeted deletion of PBP in liver parenchymal cells, using Cre-loxP system, resulted in the abrogation of peroxisome proliferation as well as the induction of PPARα-regulated genes in mouse liver in response to peroxisome proliferators. In essence, the absence of PBP in hepatocytes in vivo mimics the absence of PPARα indicating that coactivator PBP is a specific downstream regulator of PPARα regulated gene expression in liver parenchymal cells.

MATERNAL BEHAVIOR IN BLACK RHINOCEROSES

Presenter
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Mentor
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Maternal behavior is dynamic, and expected to vary as offspring age. Using both scan and all-event sampling, approximately 40 hours of data has been gathered on a female black rhinoceros since shortly after the birth of her calf in September. The time budget of the female has changed since the birth of the calf; for example, she spends more time alert as the calf ages, and spends more time away from the relative shelter of the back corner of the exhibit. The frequency, type, and initiator of events such as rubbing (nuzzling) and aggression have also changed as the calf becomes more active. The female also reacts to crowd levels, resting less and initiating more events when the crowd is moderate as opposed to low. The next steps of this research would be to see how the female's behavior continues to change as the calf ages and how mother and calf behave when permitted to go into the outdoor enclosure.

BUILDING AN ARCHAEOLOGY WEBSITE

Presenter
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Mentor
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This project provided amateur archaeologists with a webpage to guide them on basic practices. Working with the Gossman Archaeology team, learning starndard excavation techniques ath the dig site, and photographing the processes and procedures, a website was built. The website provides a tutorial, discussing site selection, clearing and preparing the site, site sampling methods, and excavation methods. In designing the website, attention was paid to ease of use, aesthetics, and the needs of different users (for example, those without high-speed internet connections). Two versions of the website were created; one with the demonstrative pictures taken of the Archaeology team's work, and one with text only, to enable speedier downloads.. This website provides a valuable resource to those interested in learning about basic archaeology.

DEVELOPING SMALL INHIBITORY RNA (SIRNA) IN ORDER TO EXPLORE THE FUNCTIONAL RELEVANCE OF PROTEINS THAT INTERACT WITH THE MLL (MIXED-LINEAGE LEUKEMIA) PROTEIN

Presenter
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Dr. Nancy Zeleznik-Le, Loyola University Medical Center, Dept. of Oncology Building 112, room 337, 2160 S. 1st Ave, Maywood, IL 60153; 708-327-3368

Disruptions in the MLL (mixed-lineage leukemia) gene, located on chromosome 11 bandq23, cause leukemia. A possible method of understanding the role of MLL in causing leukemia is by determining which proteins interact with MLL to mediate its function. Several proteins have been shown to interact with the MLL repression domain, including the histone deacetylases, HDAC1 and HDAC2, and the polycomb protein HPC2. Small inhibitory RNA (siRNA) is a valuable means of exploring what would happen to MLL's function in the absence of these proteins. Small inhibitory RNA interferes with a targeted region of a specific messenger RNA and induces degradation of this mRNA. In my project, I designed several different siRNA molecules to target the mRNAs of proteins that bind to MLL. I cloned these RNA molecules into a retroviral vector and sequenced the clones. We will use these siRNA retroviruses to "knock-down" the expression of the relevant genes in either mouse or human cell lines. I will use RT-PCR analysis to determine whether the siRNAs that I designed specifically decreased the expression of the targeted proteins.

ANTIMICROBIAL PEPTIDE PC-17 INSERTION INTO LIPID MONOLAYERS

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PC-17 is a modification of the antimicrobial peptide protegrin-1 (PG-1), which is isolated from porcine leukocytes. Previous studies have shown that PG-1 interaction with cellular membranes is dependent upon the composition of the membrane, and the results of this study suggest that the same would be true of PC-17. In this study, Langmuir monolayers are used to mimic the outer membranes of bacterial and mammalian cells. The insertion of PC-17 into these monolayers at varying surface pressures has been observed by measuring the degree of insertion of the peptide into the monolayer and also through fluorescence microscopy images. PC-17 showed relatively high levels of insertion into monolayers composed of lipids present in bacterial membranes [dipalmitoylphosphatidylglycerol (DPPG) and lipid A] and low levels of insertion into monolayers composed of lipids present in mammalian cell membranes [dipalmitoylphosphatidylcholine (DPPC)] at surface pressures varying between 25 mN/m and 35 mN/m. Fluorescence microscopy indicated significant disordering of membrane packing in the DPPG membranes after the insertion of the peptide, but little or no difference in membrane morphology for DPPC after insertion. DPPG and lipid A are major components of the outer membranes of Gram positive and negative bacterial cells, respectively, while DPPC is a component of mammalian red blood cell membranes.

TRANSLOCATION OF PROTEIN KINASE A TO FOCAL ADHESIONS CAUSES CYTOSKELETAL REORGANIZATION AND ANOIKIS

Presenter
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Protein kinases play integral roles in intracellular signaling pathways, which control virtually all aspects and processes of the cell. Recent studies have shown that the positioning of these events in cells is much more sophisticated than initially thought. Thus, the function of protein kinases at specific locations within the cell is of particular interest. Protein kinase A (PKA) plays a crucial role in metabolism, proliferation, gene transcription, and apoptosis. Here, we focus on the role of PKA in cell structural integrity. By targeting the PKA protein to focal adhesions (FAs), points of cellular adhesion to the extracellular matrix, we show that PKA cause certain cell types to change shape, round up, lose adherence, and die. This is the first evidence of PKA's effect at FAs and has key implications for regulation of normal and tumor cell growth.

CELL APOPTOSIS AND TANGLE FORMATION IN ALZHEIMER'S DISEASE

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Mentor
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One of the paramount pathological indicators of Alzheimer's Disease is the presence of neurofibrillary tangles. There is also an increase in cell death and it has been suggested that apoptosis is a means by which these cells are lost. However, the relationship between apoptosis and tangle formation is not readily apparent. This study examined the relationship of Tdt-mediated UTP nick-end Labeling (TUNEL) positive nuclei and neurofibrillary tangles. The study found that apoptosis does not occur in neurons; rather, the apoptotic distribution indicates that its preponderance occurs primarily in glial cells, specifically oligodendrocytes. In spite of this finding, the number of TUNEL positive nuclei increased with tangle severity, indicating that the two processes may be related. Therefore, the destruction of glia in the brain may weaken the glial network, thereby undermining the functionality of neurons and acting as a precursor to tangle formation.

MERCOSUR AND THE INTEGRATION PROCESS

Presenter
Nancy Xu, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL, 60506; yinan@imsa.edu

Mentor
Dr. Graziella Prieto de Reyes, Consulate of Uruguay, 875 North Michigan Avenue Suite 1422, Chicago, IL, 60611; 312-642-3430; conuruchi@aol.com

The Southern Common Market Agreement created a common market among Argentina, Brazil, Paraguay, and Uruguay. All four countries are integrating into the global market and must expedite their domestic economic development. To achieve this, Mercosur was established to optimize the utilization of resources and to synchronize macroeconomic policies. Politically, the union gives its members greater negotiation power in the international arena. Furthermore, it presents a safety net over which economic and social developments are made. Economically, Mercosur guarantees better allocation and a wider scale of production as well as an extended market to attract foreign investors. However, the road to integration is not easy. The discrepancy in individual levels of economic and social development can cause imbalanced progress. In addition, protectionist sentiments inhibit the complete elimination of intra-tariffs. The reluctance of member states to make certain trading concessions does not facilitate integration. Yet despite these challenges , trade has quadrupled in the bloc since its creation in 1991. As a global trader, Mercosur has been showing consistent GDP growth. Thus overall, the benefits of open regionalism in Mercosur far outweigh the difficulties that its members must overcome.

IMPACT OF AROMA ON PERCEPTION OF AGE

Presenter
Ying Ye, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL, 60506; amyye@imsa.edu

Mentor
Dr. Alan Hirsch, Smell & Taste Treatment and Research Foundation, Ltd, 845 North Michigan Avenue, Suite 990W, Chicago, IL, 60611; 312-938-1047; 312-649-0458; Dr.Hirsch@core.com

While the determination of age has been primarily mediated visually, the ambient odor may also have influence. To determine this, thirty-seven subjects (age average of 28 years, ranging from 13 years to 71 years), in a single, blinded, randomized fashion, estimated the age of models in twenty photographs while wearing either blank masks or masks impregnated with a grape, cucumber or grapefruit aroma. The grape odor ($p = 0.198$) and the cucumber odor ($p = 0.244$) had no effect. The grapefruit aroma reduced subjects' perception of overall models' ages by an average of approximately three years ($p = 0.025$) and of female models' age by five years ($p = 0.053$). Possible mechanisms whereby the grapefruit aroma created a rejuvenating effect with relationship to perceived age includes induction of positive affect, expectancy effect, sexual arousal, anxiolysis, change in cognitive set. The perceived rejuvenating effect of the grapefruit aroma may have utiiity in facilitating inter generational communication or act as an adjuvant in cosmetic and pharmaceutical usage to affect age perception, like Botox, with less associated risk.

THE ROLE OF TR ALPHA ON HYPOTHALAMIC TRH

Presenter
Joanna Zhang, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL, 60506; jzhang@imsa.edu

Mentor
Dr. Eva Redei, Northwestern University Medical Center, 303 E. Chicago Ave, Chicago, IL, 60612; 312-908-1791; e-redei@northwestern.edu

Thyroid hormone deficiency during perinatal development is linked to behavioral and cognitive alterations, including slower learning, hypoactivity, and increased depressive behavior. These are irreversible consequences if not treated with thyroid hormone supplement within the first ten days of birth. Thyroid hormone receptors are present in brain regions that contribute to these behaviors. Our study focuses on whether thyroid hormone receptor alpha (TRa) affects hypothalamic thyroid releasing hormone (TRH) expression. TRH participates in a classical negative feedback regulation of the hypothalamus-pituitary-thyroid (HPT) axis. In this circuit, the hypothalamus is responsible for secreting TRH which stimulates the pituitary to release thyroid stimulating hormone (TSH). In response, the thyroid produces T4 and T3, of which T3 binds to TRain order to regulate TRH and TSH release. Through examination of the brains of thyroid receptor alpha null (TRa (o/o)) mice, we are characterizing TRa's role in hypothalamic TRH production. These knock-out mice lack all isoforms of the TRa subunit. Additionally, we are using C57BL/6 control mice of corresponding age and sex who have normal thyroid functions. Several experimental techniques must be performed. After being anaesthetized, the mice are perfused through the heart and fixed with paraformaldehyde. The brains are removed and sliced 220μm thick using a cryostat. These slices are mounted on slides in preparation for TRH immunohistochemistry. Antiserum against prepro TRH 178-199 will be used as a marker for TRH-containing neurons in the hypothalamus. Final analysis of the altered peptide levels in the hypothalamus will determine whether or not thyroid hormone-associated alteration in the expression of hypothalamic TRH is due to the absence of TRa in the brain.

SYMPHONIC SUMMER MUSIC CAMP@IMSA

Presenter
Alice X. Zhao, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL, 60506; alicez@imsa.edu

Advisors
Ms. Britta McKenna, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Kids Institute, Aurora, IL, 60506; 630-907-5987; britta@imsa.edu

Dr. Gregg Porter, Illinois Mathematics and Science Academy, 1500 Sullivan Road, Aurora, IL, 60506; 630-907-5932; gporter@imsa.edu

The IMSA Kids Institute® has provided prospective students with a variety of educational enrichment summer programs since 1998. At the beginning of the school year, eighty surveys were distributed to Chicago area middle school band and orchestra directors to gauge interest in a local summer music day camp. Of the eighteen teacher responses, 83% confirmed interest. The focus of this inquiry was to develop an innovative symphonic music camp for middle school students designed by IMSA students . An application process was created that included a brochure, taped audition recording, and teacher recommendation to assure music level 2-3 student performance. A dedicated group of IMSA students developed camp curriculum including the following student-led activities: music composition, singing and dancing, practicing made fun, everyday music, and music interpretation. The camp also features master classes by IMSA/visiting music faculty and full group rehearsals. The goal of this camp is to inspire students and to teach them that music is not only about drill and practice, but also about enjoyment and fun! The end result is that both IMSA student teachers and music students will discover (or rediscover) their love for music.

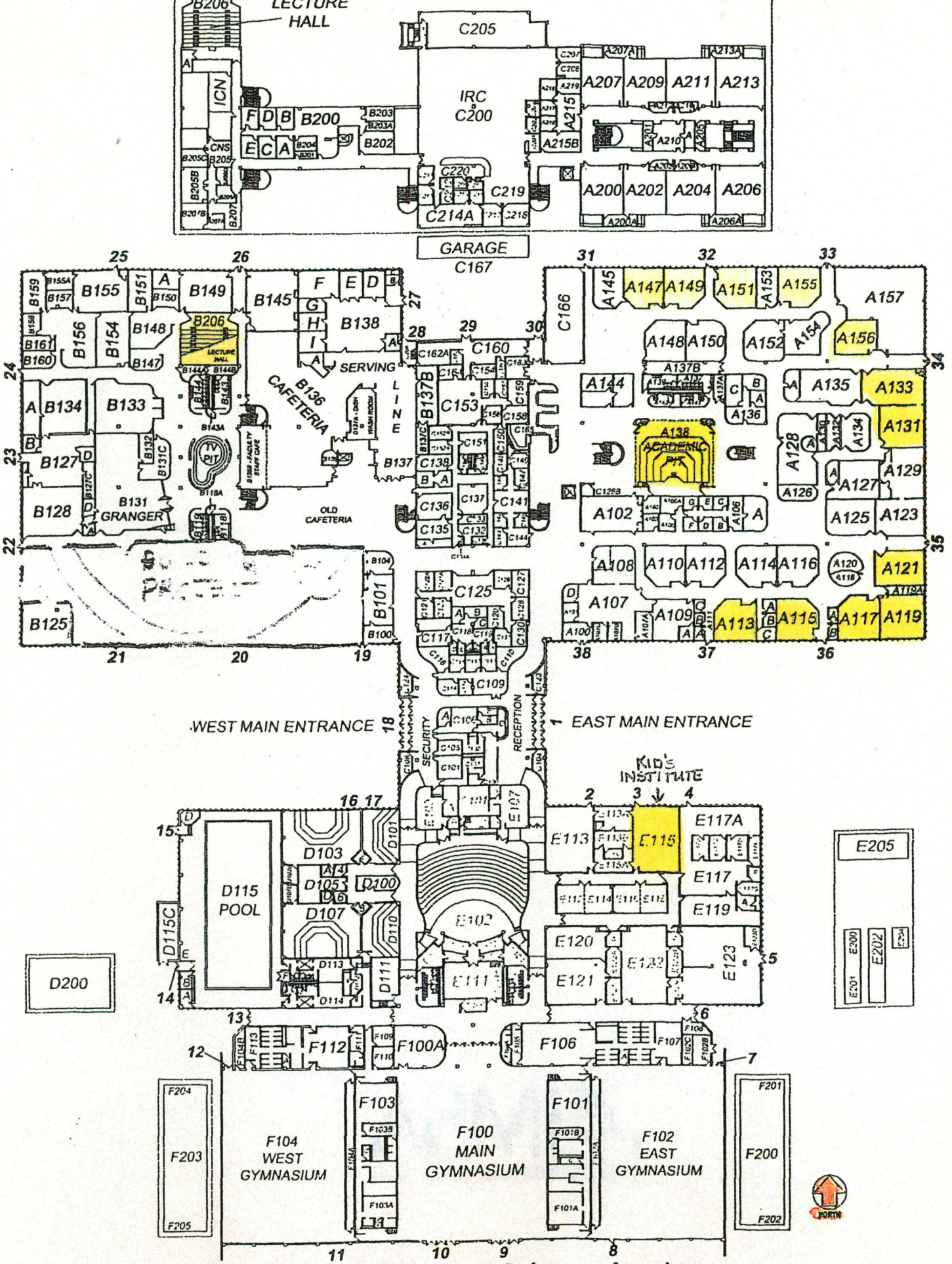
Name	Time/Room	Time/Room	Time/Room
Amanda Adeleye	12:55 / A-151		
Jawwad Akhtar	10:50 / A-119		
Andrea Albright	1:45 / Kids Institute E-115		
Michael Andreoli	9:10 / A-119		
Tricia Aung	1:45 / A-155		
Sarah Bagnall	11:15 / Kids Institute E-115		
Rashi Bamzai	9:10 / A-149		
James Bao	10:25 / A-133		
Steven Benario	12:30 / A-151		
Rishi Bhayana	11:15 / A-113	12:55 / A-113	
Paras Bhayani	12:30 / A-117		
Hussein Bhikhapurwala	10:00 / A-149		
Rohan Bhobe.	12:55 / A-133		
Margaret Biel	1:45 / Lecture Hall		
Tracey Blasingame	1:20 / Kids Institute E-115		
Kevin Bock	10:50 / Lecture Hall	11:15 / Lecture Hall	
Kora Bongen	10:00 / A-155		
Jordan Burdinie	10:25 / Lecture Hall		
Emma Cape	9:35 / A-117		
Aretha Chakraborti	11:15 / A-155		
Manisha Chandar	2:35 / A-151		
Eric Chang	2:35 / A-115		
Jeffrey Chang	12:30 / A-115		
Huijia Chen	1:45 / A-119		
Jim Chen	12:55 / A-117		
Sarah Cheng	1:45 / A-119		
Karen Chien	2:35 / A-121		
Connie Choi	9:35 / A-121		
Christina Chou	1:45 / Kids Institute E-115		
Jonathan Chou	1:20 / A-115		
Emily Coleman	2:10 / A-147		
Raymond Colletti	9:35 / A-147		
Timothy Credo	9:35 / A-151		
Sarah Curry	11:15 / A-149		
Jennifer Cutler	10:25 / A-131		
Janet D Souza	10:50 / Kids Institute E-115		
Jonathan Delich	10:00 / A-147		
Alexander Deriy	10:50 / A-151		
Kathryn Dirks	12:30 / A-155		
Uchenna Egwu	2:35 / Lecture Hall		
Justin Eusebio	11:15 / A-147		
Kevin Flannery	11:15 / A-115		
Christine Foster	2:35 / A-147		
Alexander Fu	10:50 / A-149		
Pooja Gala	12:30 / A-121		
Raj Gala	2:10 / A-117		
Alicia Gines	1:45 / Kids Institute E-115		
Vijay Govind-Thomas	11:15 / A-147		
Derayvia Grimes	12:30 / Lecture Hall	12:55 / Lecture Hall	

Name	Time/Room	Time/Room	Time/Room
Sarah Grothen	1:20 / A-155		
Abhi Gulati	9:10 / A-151		
William Hahm	9:35 / A-151		
Heather Haines	11:15 / A-156		
Isaac Han	10:25 / A-155		
Laura Hawkes	10:50 / A-113		
Jasmine Henry	2:35 / A-119		
Carl Herrmann	1:20 / A-121		
Lisa Hickok	10:25 / A-131		
Sharon Hong	12:30 / A-131		
Alisha Howell	11:15 / A-133		
Aaron Hutcherson	12:30 / Lecture Hall	12:55 / Lecture Hall	
Tram Huynh	9:35 / A-115		
Lynda Ikejimba	10:00 / A-119		
Aarti Israni	12:30 / A-149		
Amanda Jablonsky	9:35 / Lecture Hall		
Akta Jantrania	12:55 / A-149		
Elizabeth Janusick	1:45 / A-113		
Lauren Jarocha	10:00 / A-119		
Sarah Jeong	2:35 / A-155		
Abigail Johnson	9:35 / Lecture Hall		
David Johnson	9:10 / A-147		
Sophia Kamran	10:00 / A-131		
Arielle Kanters	12:55 / A-131		
Jackson Keating	9:10 / Lecture Hall		
Charles Keaton	2:10 / A-131		
Andrew Keller	10:50 / A-133		
Christopher Kervick	1:20 / Kids Institute E-115		
Nahree Ki	1:45 / Kids Institute E-115		
Veda Kilaru	12:30 / A-121		
Eugenia Kim	2:10 / A-149		
Heidi Kim	2:10 / A-155		
Jenny Kim	2:35 / A-131		
Mimi Kim	11:15 / A-151		
Joshua Kinder	9:10 / Lecture Hall		
Amber Kirchhoff	12:30 / Lecture Hall	12:55 / Lecture Hall	
Heidi Knappenberger	9:10 / A-156		
Annie Ko	10:25 / A-151		
Andrew Koester	10:00 / A-151		
William Konrad	1:20 / A-147		
Jakob Kotas	12:55 / A-115		
Rachel Kovac	10:00 / A-113		
Sharad Kumar	10:25 / A-147		
Torance Kuntzelman	10:25 / A-155		
Michelle Kwan	1:45 / A-147		
Azmina Lakhani	10:50 / A-113		
Craig Landers	1:20 / Lecture Hall		
Daniel Lee	1:20 / A-117		
Ashley Levato	9:10 / Lecture Hall		
Casey Lewis	12:55 / Kids Institute E-115		

Name	Time/Room	Time/Room	Time/Room
Amy Li	10:00 / A-131		
Brook Li	9:10 / A-131		
Jered Linares	1:20 / A-121		
Conan Liu	12:55 / A-149		
David Liu	10:50 / A-119		
Yuan Liu	11:15 / A-119		
Mary Logue	9:35 / Lecture Hall		
Jason Lu	10:25 / A-119		
Alex Ma	10:25 / A-119		
Amit Mahadevia	12:30 / A-113		
Robert Main	9:35 / A-147		
Martha Malin	1:45 / A-131		
Amanda Maloka	1:45 / A-133		
Jenna Maloka	1:45 / A-133		
Kevin McHugh	1:20 / A-147		
Bhavi Mehta	2:35 / A-117		
Amanda Metz	12:30 / Kids Institute E-115		
Yugarshi Mondal	9:10 / A-155		
Daniel Moorehead	10:00 / A-133		
Kate Moss	9:35 / A-113		
Maciej Mroczek	11:15 / A-121		
Lucy Na	1:20 / Kids Institute E-115		
Darshana Nair	1:45 / A-115		
Sridhar Narla	11:15 / A-121		
Megan Narula	2:35 / A-149		
Amit Nathani	11:15 / A-117		
Carly Nix	1:20 / Kids Institute E-115		
Julia Novitski	1:20 / A-133		
Alexis Nwankwo	9:35 / A-149		
Courtney Ofosu	12:30 / Lecture Hall	12:55 / Lecture Hall	
Michael Onyiego	9:35 / A-131		
Jonathan Page	9:10 / A-113		
David Pai	12:55 / A-121		
Jeanie Paik	10:25 / A-113		
Jessica Parr	9:10 / Kids Institute E-115	9:35 / Kids Institute E-115	
Rachael Parrish	10:50 / A-155		
Stephanie Pasquesi	12:55 / A-147		
Kevin Patel	9:35 / A-156		
Mikin Patel	9:10 / A-133		
Amy Peterson	10:00 / A-147	10:50 / A-121	
Ann Peterson	10:25 / A-131		
Violet Petriciole	10:50 / A-131		
Joseph Phan	1:45 / A-117		
Ganon Pierce	12:55 / A-119		
Susan Pinto	9:10 / Kids Institute E-115	9:35 / Kids Institute E-115	
Michael Plachta	9:10 / Lecture Hall		
Kristen Pratt	10:00 / A-117		
Shareese Pryor	10:25 / Kids Institute E-115		
Sanaa Qamar	2:10 / A-151		
David Qasem	9:35 / A-156	10:25 / A-156	12:30 / A-156

Name	Time/Room	Time/Room	Time/Room
Kyle Rader	10:00 / A-115		
Monica Radosevich	10:00 / A-131		
Nithya Rajagopalan	10:50 / A-147		
Manjari Ranganathan	10:25 / A-149		
Ajay Reddy	2:10 / A-113	2:35 / A-113	
Jarnia Reed	12:30 / Lecture Hall	12:55 / Lecture Hall	
Fred Ricks	2:35 / Lecture Hall		
Emmalyn Riley	9:35 / A-155		
Clement Robinson	1:20 / Kids Institute E-115		
Alexandra Robles	9:35 / Lecture Hall		
Nicholas Rossi	10:00 / A-149		
Whitney Rossmiller	9:35 / A-113		
John Ruddy	11:15 / A-131		
Danielle Ruffin	10:25 / A-131		
Adam Sadorus	10:50 / A-119		
Trisha Salkas	1:20 / Kids Institute E-115		
Rasleen Saluja	1:45 / A-151		
Michael Samano	2:10 / A-119		
Samantha Schneider	9:10 / A-113		
Anjali Sehrawat	12:30 / A-119		
Margot Seigle	10:50 / A-155		
Ami Shah	12:55 / A-155		
Sana Shaikh	9:35 / A-149		
Laura Sharpless	1:20 / A-131		
Yuguan Bailey Shen	1:20 / A-119		
Chirag Shukla	10:50 / A-115		
Katherine Siemens	1:20 / A-113		
Melissa Siew	10:50 / A-149		
Mark Simmons	9:35 / Lecture Hall		
Lindley Slipetz	1:45 / A-149		
Matthew Srednick	10:00 / A-121		
Priya Srikanth	10:25 / A-115		
Heather Taff	9:35 / A-119		
Shameeta Thanki	1:45 / A-121		
Kimberly Threlkeld	12:30 / Lecture Hall	12:55 / Lecture Hall	
Tiffany Todd	9:35 / Lecture Hall		
Snehalata Topgi	10:25 / A-117		
Amanda Townsend	12:30 / A-147		
Christopher Trigg	12:30 / A-147		
Michael Tu	2:10 / A-115		
Darian Turner	12:30 / Lecture Hall	12:55 / Lecture Hall	
Mackenzie Van Camp	9:10 / A-117		
Vyas Viswanathan	10:25 / A-156		
John Vogel	10:00 / Lecture Hall		
Rachel Voss	9:10 / A-133		
Nisha Wadhwani	10:25 / A-121		
Danielle Wadlington	12:30 / Lecture Hall	12:55 / Lecture Hall	
Madeleine Walsh	1:20 / A-151		
Peter Wang	9:35 / A-133		
Shuhao Wang	9:10 / A-133		

Name	Time/Room	Time/Room	Time/Room
Tim Wang	10:50 / A-117		
Andrey Warkentin	10:00 / A-151		
Anthony Waymire	12:55 / Kids Institute E-115		
Shanna Wilcox	11:15 / A-133		
Anna Wilewska	1:20 / A-121		
Takeshia Williams	12:30 / Lecture Hall	12:55 / Lecture Hall	
Kevin Wombacher	9:10 / A-119		
Anna Wu	10:25 / Lecture Hall		
Karen Wu	11:15 / Kids Institute E-115		
Nancy Xu	9:10 / A-115		
Feifei Xue	12:30 / Kids Institute E-115		
Munan Xue	10:25 / A-133		
Dunping Yang	1:20 / A-115		
Allen Ye	2:10 / A-115		
Junwei Ye	12:30 / Kids Institute E-115		
Ying Ye	9:10 / A-121		
Helen Yeung	12:30 / Kids Institute E-115		
Jill Zaveri	12:55 / A-155		
Rishi Zaveri	9:10 / A-155		
Joseph Zearing	12:55 / Kids Institute E-115		
Joanna Zhang	2:10 / A-121		
Alice Zhao	10:00 / Kids Institute E-115		



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REVISED: 25 OCT 2002


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